ARCHIVES
1955

Ex libris
universitatis
albertaensis

Universal Bindery Ltd.
BOOKBINDING – GOLD LETTERING
Edmonton, Alberta

Digitized by the Internet Archive
in 2017 with funding from
University of Alberta Libraries

https://archive.org/details/seeingthroughari04hart_1

Teaching guide

for Seeing through arithmetic 4

This is the Teaching Guide for *Seeing Through Arithmetic 4,* the fourth book of The Basic Mathematics Program, which is a unit of THE CURRICULUM FOUNDATION SERIES ®, published by Scott, Foresman and Company.

The authors of this book are Maurice L. Hartung, Professor of Education, University of Chicago; Henry Van Engen, Professor of Education and Mathematics, University of Wisconsin; and Lois Knowles, Professor of Education, and Elementary Supervisor, Laboratory School, University of Missouri.

A collaborator in the preparation of this book is R. A. Rennie, Associate Professor of Psychology, University of Saskatchewan.

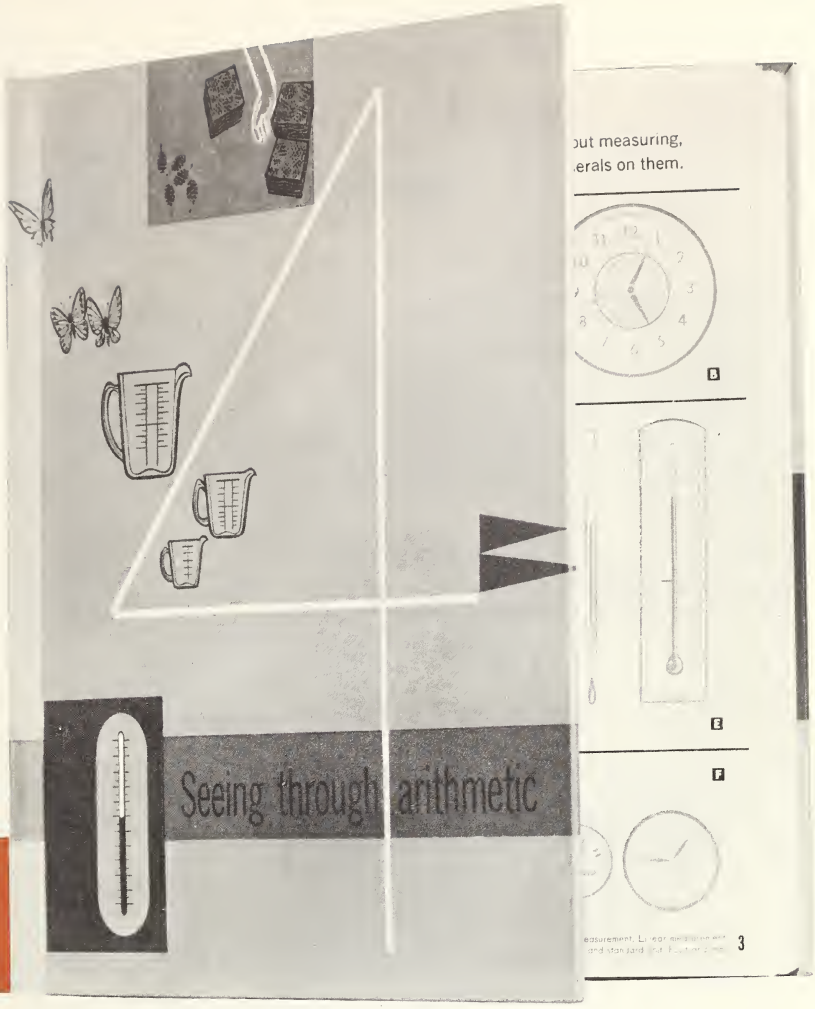
This book was prepared by the editorial staff under the direction of George E. Russell, Directing Editor of The Basic Mathematics Program.

This book was designed by William Nicoll and illustrated by Janet LaSalle.

Teachin

LIBRARY OF THE UNIVERSITY OF ALBERTA

uide



Scott, Foresman and Company

Chicago, Atlanta, Dallas, Palo Alto, Fair Lawn, N.J.

Copyright© 1956 by Scott, Foresman and Company. Philippines Copyright, 1956, by Scott, Foresman and Company
Printed in the United States of America. International Rights Reserved.

Getting acquainted with this book

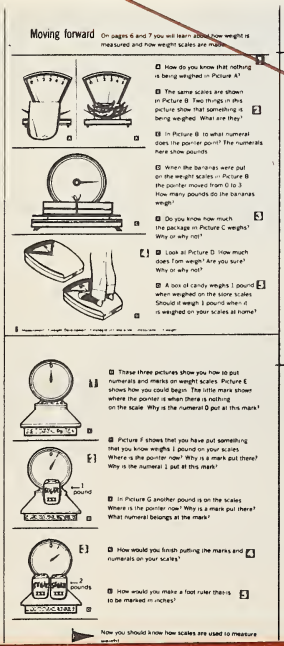
In this *Teaching Guide* you will find several different kinds of help in planning your work.

The various kinds of help are so organized as to meet the varied needs of teachers. For some, the brief notes keyed to the reproduced pages from the pupils' book may be sufficient. Others may want to use the Expanded Notes and activity suggestions. You can decide for yourself how much use to make of these various materials in the *Teaching Guide*.

A section called

Lesson briefs on pages 15-225

provides, through reduced reproductions of pupils' lesson pages, accompanied by short, keyed teaching suggestions, a quick overview of how to teach the lesson pages in each block of work. Also provided for you are objectives, a list of new vocabulary, brief comments on the block of work in general, and an answer key for all exercises (except those concerned with the basic facts) and problems.

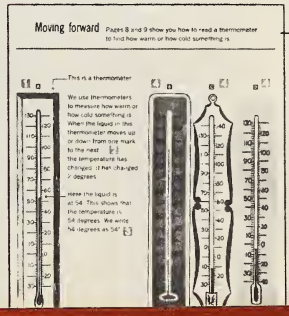

Moving forward On pages 6 and 7 you will learn about how weight is measured and how weight scales are made.

6

1 Have the children answer Question A. Be sure they observe that the pointer is precisely at zero.
2 Have the children answer and discuss Questions B, C, and D
3 Let the children give estimates of the weight of the package. Let them give reasons for thinking it weighs a certain amount, and then let them discover from the variety of estimates and reasons that it is impossible to tell. Help them see that weight scales are of no use unless they have a scale marked with numerals.
4 First let the children talk about the two views of the bathroom scales. Be sure they observe that the pointer on the empty scales is not exactly at zero. Discuss whether the boy on the other scales really weighs a little more or a little less than 85 pounds.
5 Have them answer and discuss Question G. Be sure they understand that an object should weigh the same on all scales.

7

1 Have the children answer and discuss Question H. Be sure they understand that the zero mark should be where the pointer points when there is nothing on the scales.
2 For Exercise I let the children talk about what has happened to the scales. Be sure they understand why the numeral 1 is put where it is.
3 Proceed in the same way for Picture G and Exercise J.
4 Discuss Question K and the way to continue by putting more pounds of sugar on the scales and making marks an equal distance apart.
5 Have the children answer and discuss Question L. Be sure they understand that the scale on a foot ruler is like the scale on a weight scales in principle. Ask them to tell how using weight scales is like using a foot ruler.
6 Direct attention to the statement following the flag and have a brief concluding discussion about the measurement of weight.


Moving forward Pages 8 and 9 show you how to read a thermometer to find how warm or how cold something is.

8

1 Direct attention to Thermometer the picture with the children know that the tube on the th filled with a liquid (which is us red) and that the marks and num thermometer are a scale
2 Have one of the children read graph at the right of the therma the way the scale is marked and understand that each space re degrees. Ask them if they ca reason why each space should grees instead of one (no room fo and numerals).
3 Have the children read this pa sure they understand that we read eter by looking at the mark ne of the liquid in the tube. Ask th would read the thermometer wh the liquid is between two marks
4 Discuss the differences in these

8-9 Moving forward

Expanded Notes for the lesson are on pages 210-211

Objectives
The child learns how to read a Fahrenheit thermometer, and he learns what the freezing and boiling points of water are.

Vocabulary
New words page 8 thermometer, warm*, cold*, liquid, temperature, degrees, **page 9** above*, below*, lowest*, worry*, cooking*, freezes, boils*, water*

Comments
One great difficulty the children will have with measuring temperature with a Fahrenheit thermometer is to understand the reason the zero point of the scale is where it is. It will be hard for them to understand why zero is not the freezing point.

Be sure the children understand that the liquid in the thermometer rises and falls as the temperature changes because the liquid expands when it becomes warmer and contracts when it becomes colder.

Let the children read a real thermom discuss and, if possible, bring to class, diff thermometers they have seen used (weathe candy, oven). Help them decide why the of thermometers have different ranges of perature readings. Be sure they understan thermometers each interval represents tw

Answers
Page 9 A 94°, because each mark repre grees, not one degree; B Below 0°, becau is below the 0 on the scale; C Above 0°, E 130°, F 120°, 140°, 130°, G 20° below 0, 40° below 0; H Moves down the scale, I goes from the coldest to the hottest tem are likely to have; J No, there are no nu scale; K Because the temperature is alm freezing, and his crops may be ruined; L B foods need cooking temperatures above 2 ing point of water; M C and D; N Scales high enough temperatures

A section called

Expanded notes

on pages 227-328

gives detailed suggestions for teaching each lesson. The Expanded Notes for each block of work are organized to provide for individual differences. First there are teaching suggestions for the class as a whole, then special suggestions for able pupils, and finally, suggestions for the slow learners. Sections called "Charting the Course" are interspersed throughout the Expanded Notes to introduce a block of work or related blocks of work. They describe how the block of lessons in the pupils' book fits into the arithmetic program. They may be read all at one time or individually as the work with the book progresses. You should, however, have these general principles in mind as you examine the more detailed suggestions that are provided for teaching each lesson.

A section called

Activities

on pages 329-352

is a real source book of games and activities useful in arithmetic. References to them are made in the Expanded Notes, but they can be used at other times.

A section called

Reference materials

on pages 353-368

provides you with a useful bibliography, a description of the problem types, a grade-placement chart for the program, a suggested time schedule, alphabetical word list, table of mathematical content, and an index.

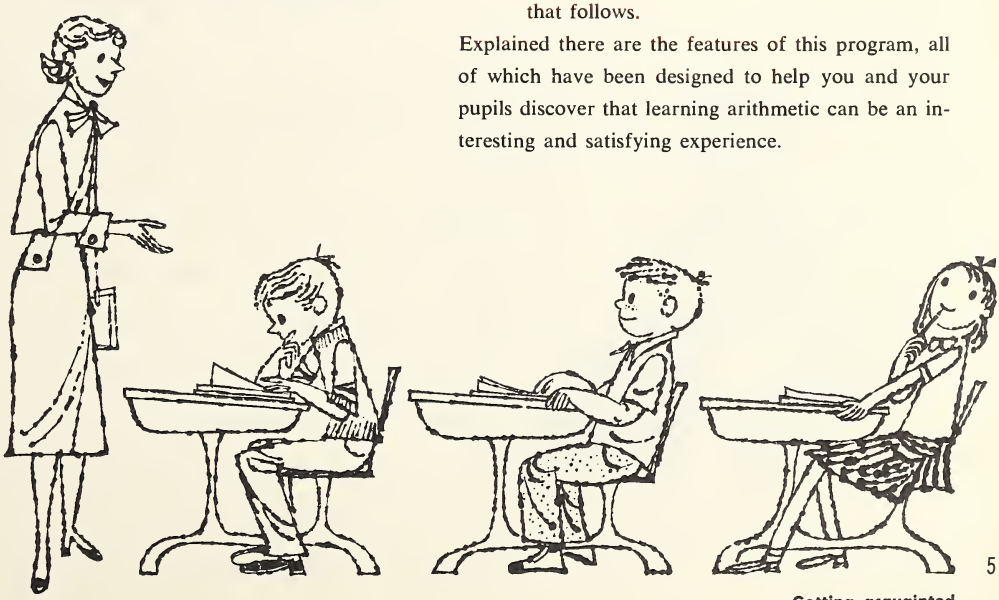
You will find it profitable to read the brief overview of the major features of the *Seeing Through Arithmetic* program described

in the section

Guiding principles

that follows.

Explained there are the features of this program, all of which have been designed to help you and your pupils discover that learning arithmetic can be an interesting and satisfying experience.



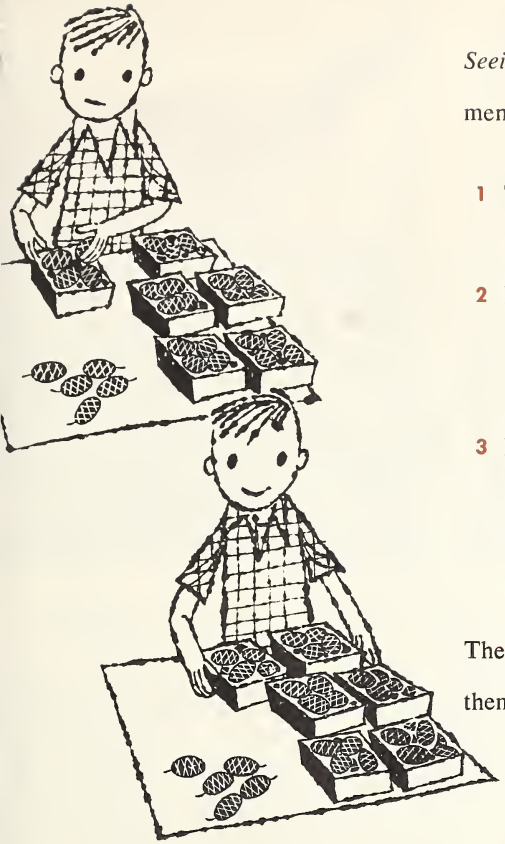
Guiding principles

Arithmetic is a fundamental subject.
Children should learn to use it with ease,
with confidence,
and with enjoyment.

The best way to reach this goal is to help children gain insight into arithmetic.

The objective: insight

"Insight" is a term that has come into prominence in modern psychology. Insight depends upon the recognition of relationships. When insight occurs, the parts that make up a total situation are seen in relation to each other and to the whole situation. The number system, for example, involves many relationships. When children have gained insight as to these relationships, a great many facts that would otherwise remain isolated are recognized as elements of a few general principles. The processes of arithmetic, for example, become understandable, and not just a set of arbitrary rules.



Seeing Through Arithmetic 4 provides for the development of insight in three major ways:

1. The learning of arithmetic is simplified by the way the work is organized.
2. Problem solving is clarified by use of principles and techniques that help pupils learn to analyze problem situations.
3. New and improved methods of presentation are systematically used to make the learning of arithmetic easier and more enjoyable than it has been in the past.

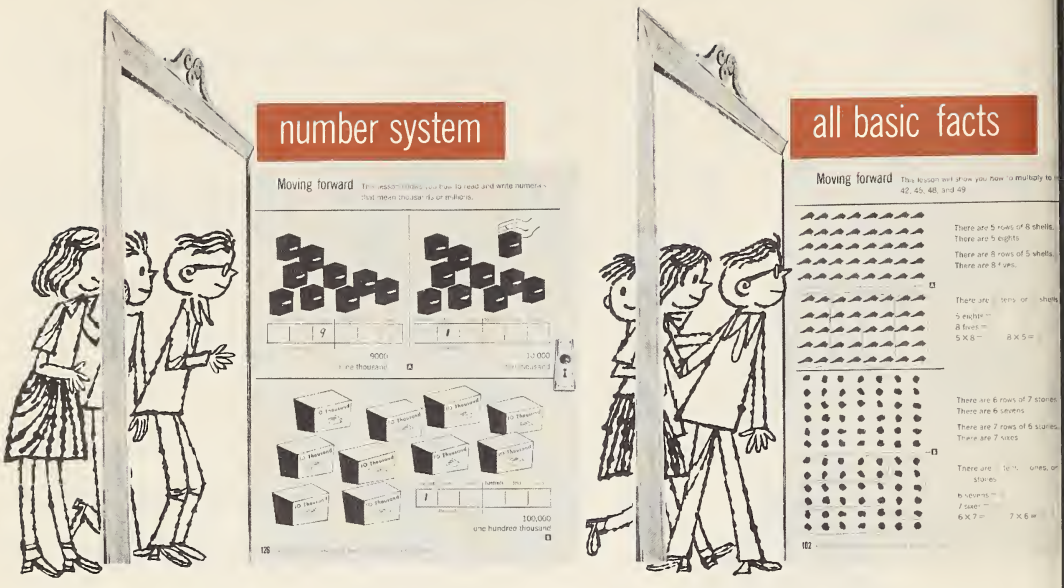
These features and the psychological backgrounds for them are explained in the following sections.

1 Simplified organization

Organization of the learning situation is of great importance in fostering insight. When the aim is recognition of relationships, the work must be organized to achieve this purpose. The effect is then cumulative: better understanding at each stage contributes to better understanding at following stages. The result is that fewer treatments of a topic are needed, and the organization of the subject as a whole is simplified.

For several decades the trend in arithmetic was toward increasing complexity in the organization of topics. This came about because the stimulus-response theory dominated instruction in arithmetic. With this psychology as a basis, drill played a dominant rôle. Every desired response was specifically identified and connected to a stimulus for it.

The process of multiplication, for example, was usually separated into many—a dozen or more—dif-



Doors to success—knowing the number system and the basic facts; seeing ideas as wholes; visualizing

ferent "skills." Multiplication of two-figure numbers *with* carrying was delayed for weeks or even months after multiplication *without* carrying had been taught.

Because of these traditional organizations, children often failed to understand the nature of the task as a whole. For example, when multiplication without carrying comes first, the pupil cannot understand why he is told to begin multiplying with the "ones." He can find the right answers by working with the "tens" first. He can work the examples either way he pleases and often forms bad habits that escape notice by the busy teacher. In the long run, lack of insight makes the situation more difficult for both pupil and teacher.

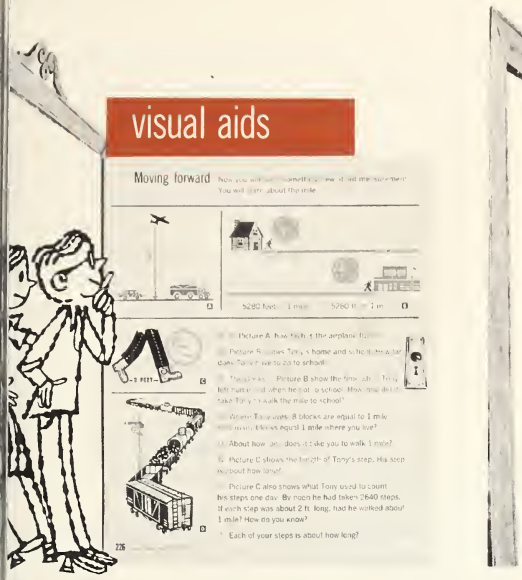
In *Seeing Through Arithmetic 4*, after the basic principle of multiplication involving multiples of 10 and 100 has been taught, the multiplication of general two-figure numbers is introduced with an example involving carrying.* When the child understands the way ones in excess of 10 must be reorganized to make tens—the major difficulty in multiplication of two-figure numbers—he has the main idea. He sees the "whole" situation. Learning to multiply by working many examples without any carrying before meeting one that does require carrying develops an incomplete concept of the process. It is like learning to drive on a street where, by special arrangement, the traffic control lights are *all* green and cease to be observed by the driver. In accordance with the same general principle, the addition of two-figure numbers is reviewed by an example that involves carrying.* The process of subtraction is reviewed by examples that require borrowing.** These examples are immediately followed by one that does not require borrowing.

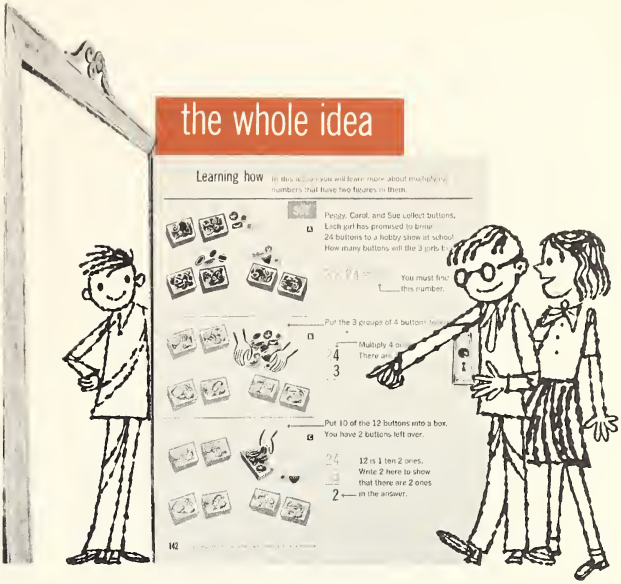
The principle of introducing a process by using examples that are as representative as possible of the process as a whole is followed throughout *Seeing Through Arithmetic 4*. The central learning difficulty is faced at the outset and is not evaded. When the pupil understands how to deal with really *representative* examples, he can use his understanding to dispose more easily of the various special cases that arise. In brief, learning tasks are so organized as to develop *insight* and to enable the pupil to use it as a means to further learning.

* See *Seeing Through Arithmetic 4*, pages 142-146.

* See *Seeing Through Arithmetic 4*, pages 20-23.

** See *Seeing Through Arithmetic 4*, pages 32-35.





Several other organizational features of *Seeing Through Arithmetic 4* are noteworthy. For example, no processing of number symbols by multiplication is introduced until *all* the basic facts of multiplication have been taught. As a result, when the computational process of multiplication is introduced, no special attention needs to be given to the selection of the number facts involved. This is in contrast to organizations of arithmetic that introduce multiplication of two-figure numbers without carrying and so on, before all the basic facts are known by the pupil. In such organizations of material great care must be taken by textbook authors and the teacher to avoid presenting examples whose processing requires factual knowledge the children have not yet acquired. These purely artificial difficulties are avoided in *Seeing Through Arithmetic 4*.

The principle of introducing all the basic facts before processing is attempted is followed also for division.

These are only a few of the many examples of reorganization suggested by psychological principles concerned with the development of insight. The simplification in organization discussed above is feasible in this program because new visual methods of presentation and provision of a good understanding of the number system are used to open the door to insight.

2 Problem solving

In *Seeing Through Arithmetic 4* insight into problem solving is fostered by the systematic use of distinctive methods of teaching. First, the pupil is helped to recognize what is happening in the problem situation. Second, he is taught to describe the situation by using arithmetic symbols. This symbolizing includes the use of very simple equations. Third, the pupil is shown how to select the proper arithmetic process to solve the equation.

Analyzing the problem situation

In the past, little has been done to help pupils develop skill in analyzing problem situations. The instructional methods have relied heavily upon "cue" words. (Examples: How many *in all?* How many are *left?*) They also have relied on advice which is of no real help to the pupil. (Examples: Read the problem carefully. Think what to do with the numbers.) The difficulty of many problems lay in the pupil's inability to analyze them.

To understand the nature of a problem, the pupil must be able to recognize the type of action that takes place. For example, when one group joins another group, the action is called *additive*. In other situations a single group is seen at first, but if part

of this group is taken away, a *subtractive* action occurs. Sometimes the objects themselves do not actually move, and it is necessary to imagine that combining or separating action occurs. In still other situations, actions occur that are called *multiplicative* or *divisive*. Such actions, real or imagined, are always important aspects of the total situation. The child learning arithmetic with insight learns to recognize each of these four kinds of action.

The teaching of problem solving in *Seeing Through Arithmetic 4* is based on clear distinctions among: (1) the recognition of the situations with their actions, (2) the use of symbols to show what is happening, and (3) the processing of the symbols—i.e., adding, subtracting, multiplying, and dividing. These distinctions are important because the process used is not always what the action of the situation seems to suggest. For example, there are problems in which the child is usually taught to subtract, but which, as he sees them, are additive situations. Thus, consider the following situation: "John has 25 cents, and a toy truck that he wants to buy costs 45 cents. How much more money does he need?" There is evidence in the research on arithmetic that children tend to think of this as an additive problem.* This tendency is not at all surprising. Some money must be combined with the 25 cents to make the needed 45 cents. All the child's previous experiences have taught him to think of the combining of two groups as an additive situation. Too often this difficulty is not recognized, and the child is told only that this is a subtraction problem. Confusion and lack of understanding naturally result.

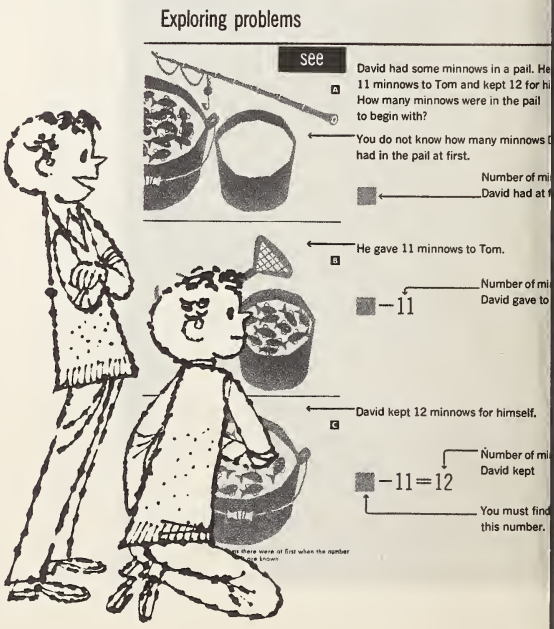
In *Seeing Through Arithmetic 4,* the child is not only permitted to think of the above situation as additive—he is taught to think this way. Although the situation is admitted to be additive, he learns that the answer is obtained by the process of subtraction. He is given help in analyzing the situation and gains insight concerning the nature of the solution. In short, he learns how to see it and how to think about it (see pages 88 to 90 of *Book 4*).

* See, for example, Gibb, E. Glenadine, "Children's Thinking in the Process of Subtraction." Unpublished doctoral dissertation, University of Wisconsin, Madison, Wisconsin. Also see Lazerte, M. E., *The Development of Problem Solving Ability in Arithmetic.* Clarke Irwin and Co., Ltd., Toronto, 1933.

Another example will help clarify the distinction. The problem reads: "Mary spent 35 cents during a shopping trip. When she arrived home, she found she had 47 cents left in her purse. How much money did Mary have in her purse before she started her shopping?" The child who understands this problem situation sees that spending 35 cents is a subtractive action. Previous experience has taught him this. However, to get the answer, he must add 35 and 47. This is a situation in which the action suggests subtraction, but the process of addition must be used to get the answer. Obviously, careful teaching is called for if the child is not to be confused.*

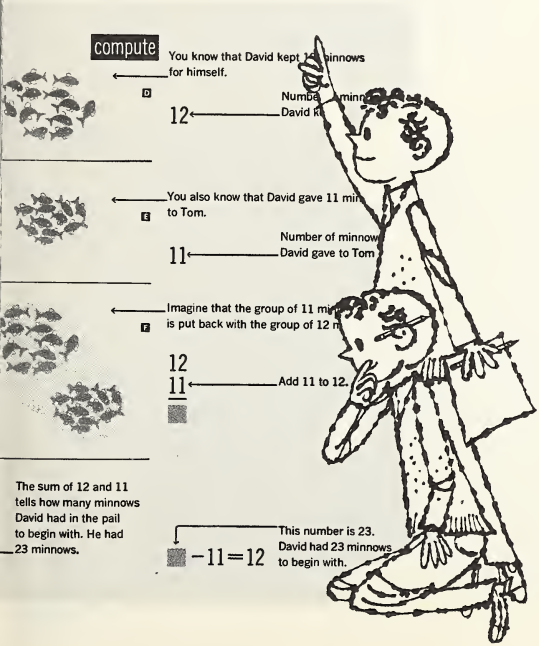
Teachers often say the difficulty in problem solving is that "the pupils cannot read the problems." The pupils usually recognize the individual words; what

* See *Seeing Through Arithmetic 4,* pages 134-137. For a more extended discussion, see the lesson notes in this *Teaching Guide* on pages 297 to 298. This situation is an example of a general type which is called "subtractive-addition" by the authors.


Exploring problems
see
David had some minnows in a pail. He
11 minnows to Tom and kept 12 for hi
How many minnows were in the pail
to begin with?
You do not know how many minnows
had in the pail at first.
Number of mi
David had at
He gave 11 minnows to Tom.
Number of mi
David gave to
−11
David kept 12 minnows for himself.
Number of mi
David kept
−11=12
You must find
this number.

the teacher means is that the pupils cannot *interpret* the *situations*. Dependence on "cue" words or other superficial techniques leaves the pupils in a weak and helpless position. They must learn to base their decisions about which process to use on an understanding of the total situation. The development of such an understanding on the part of the child has been of primary concern to the authors of this text.

The basic types of problems introduced in each grade are selected from a complete list of such types. A table of these types appears on pages 358-359 of this *Teaching Guide*. This list, which is the result of an analysis by the authors, provides a guide for a consistent and comprehensive treatment of problem solving. The eight simplest types of problems were presented in *Seeing Through Arithmetic 3*. These are reviewed and three new types are introduced in *Seeing Through Arithmetic 4*. The reader should not infer from this organization for teaching purposes that the pupil is expected to recognize each problem by its type and follow a routine procedure for that type. Some problems can be correctly viewed in more than one way. What is essential is that the pupil who adopts a possible view knows what to do with the situation as he sees it.


compute
You know that David kept 12 minnows for himself.
12
You also know that David gave 11 min to Tom.
Number of minnow
David gave to Tom
11
Imagine that the group of 11 mi is put back with the group of 12
12
11
Add 11 to 12.
The sum of 12 and 11 tells how many minnows David had in the pail to begin with. He had 23 minnows.
This number is 23. David had 23 minnows to begin with.
−11=12

Describing the situation by using symbols

As a second major aspect of problem solving, the child learns how words and other symbols are used to say or write what happens. In particular, he uses number symbols (15, 31, 5, etc.) to tell how many are in a group of objects. Other symbols ($+$, $-$, $\times$, $\div$) are used to express the actions. Thus the equation $27+46=\square$ shows that a group of 46 objects is joining a group of 27 objects and that the number of the combined group is wanted. In every case the expressions derive their meaning from the situations out of which they are seen to arise.

In *Seeing Through Arithmetic 4*, lessons entitled "Exploring problems" show the pupil how to write simple equations to describe the problem situations. This part of the lesson is labeled "See". The lessons lead him to *analyze the situation* instead of rushing on to a computational process that may or may not be appropriate. The equation focuses attention on understanding the situation and serves as a record of how the pupil sees and thinks about the situation. If the pupil cannot analyze the situation, any attempt to do the computational step is a blind and often futile procedure.

Processing the arithmetic symbols

As the third major aspect of problem solving, the child learns to go through the appropriate process with the number symbols. In the simplest situations this involves the direct use of the addition, subtraction, multiplication, or division process as indicated by the equation. In other situations, as was noted above, the process is not the same as the action in the situation suggests. In these cases the pupil must be helped to see why another process can be used. In *Seeing Through Arithmetic 4,* he is shown how to think about the situation in a way that reveals the appropriate process. He is then ready to compute with insight into the total situation. This part of the problem-solving lesson is labeled "Compute." The child's knowledge of symbols, his ability to change situations into these symbols, and his computational skills are brought together.

3 Effective methods

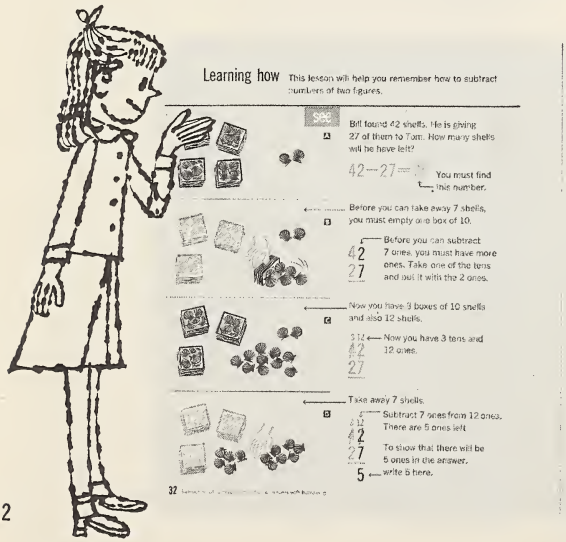
In *Seeing Through Arithmetic 4,* the learning of arithmetic is made efficient and enjoyable for most children by a variety of new methods of presentation. These methods include extensive creative use of the pictorial and typographic arts and many other features of presentation, emphasis, and organization. Introduction of these features is based on accepted principles of learning theory. These methods are used systematically, not erratically or superficially. A complete discussion of all of these methods would unduly extend these introductory comments, but some general remarks will be helpful here.

The number system

Seeing Through Arithmetic 4 provides an unusually careful development of the number system. Many pictures showing the grouping and regrouping of objects in tens, in hundreds, and so on, are accompanied by corresponding arrangements of numerals in terms of place-value ideas. (See, for example, pages 11 to 15 of the pupils' textbook.) Seeing numbers as members of a system involves seeing *relations,* and thus requires much more than knowing the names of the "places" in written numerals. There is much talk nowadays about teaching the number system. *Seeing Through Arithmetic 4* teaches it thoroughly and distinctively. In particular, the lessons provide experiences that cultivate readiness for carrying and borrowing in the computational processes that come later.

Presentation of processes

The "four-step teaching method" is another feature of *Seeing Through Arithmetic 4.* This method is used in sections called "Learning how" in which the processes are taught. (See, for example, pages 20-27 of the pupils' textbook.) In Step 1, called "See," the pupil is shown in detail what to do. Pictorial representations show what happens to the objects involved. The process with the symbols is shown and is closely connected with the visual representation. Verbal explanations are included, but they are simple and brief. In Step 2, called "Think," another example is worked out and the pupil is asked some questions about important details. He is encouraged and helped to *think* about the example. In Step 3, called "Try," other completely worked out examples are given, but the pupil is expected to work these out for himself and then compare his work with the completed examples in his book. In Step 4, called "Do," examples for practice are given. In this step the child is expected to work independently.


Learning how
This lesson will help you remember how to subtract numbers of two figures.
Bill found 42 shells. He is giving 27 of them to Tom. How many shells will he have left?
42 − 27 =
You must find this number.
Before you can take away 7 shells, you must empty one box of 10.
Before you can subtract 7 ones, you must have more ones. Take one of the tens and put it with the 2 ones.
Now you have 3 boxes of 10 shells and also 12 shells.
Now you have 3 tens and 12 ones.
Take away 7 shells.
Subtract 7 ones from 12 ones. There are 5 ones left.
To show that there will be 5 ones in the answer, write 5 here.
32

Next take away 2 boxes of 10 shells.
Subtract 2 tens from 3 tens. 1 ten is left.
Write 1 here to show 1 ten in the answer.
Bill will have 15 shells left.
42 − 27 = 15
Think
Carol and Mary together have 50 pine cones. 29 of them are Carol's. How many of the cones are Mary's?
50 − 29 =
You must find this number.
Why must you empty 1 box of 10 cones before you can take away 9 cones?
What must you do before you can subtract 9 ones?
Now turn the page.
33

The "four-step method" has proved its effectiveness through years of use. In *Seeing Through Arithmetic 4* it has been adapted to new visual techniques and modern principles of learning theory. It guides the pupil so that, literally, he can see, think, try, and really do a process on his own and with confidence.

Visual aids

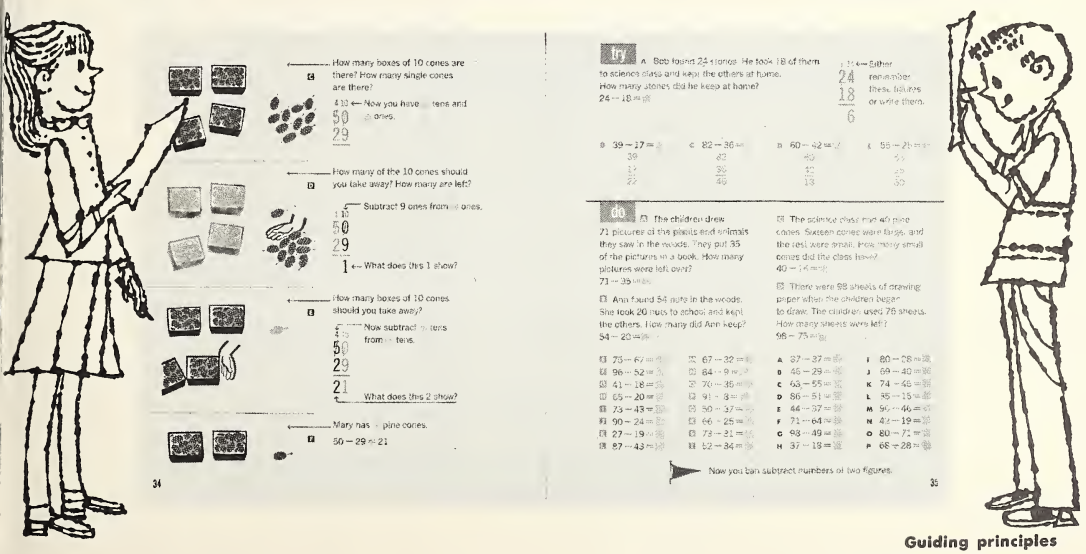
In *Seeing Through Arithmetic 4,* all pictures are learning aids. No picture is presented for its purely decorative or presumed interest-generating value. In many cases the pictures show both the basic data and the action—that is, the grouping and regrouping involved in the problem situation. The child can actually see what is happening. Moreover, because many lessons employ a sequence of related scenes, or "movies," they serve as a guide to teachers and pupils who wish to use actual objects to gain additional experience with the ideas.

In similar fashion, the use of colors and of many special printing devices is the result of careful study. Color is used not only to add general attractiveness or to call attention to some special point, but also to help teacher and pupils communicate with each other. For instance, the teacher may say, "Now we will do the examples beside the red letters." Special printing devices are used to "dim out" in pictures everything that is not to be in the focus of attention. The design of every page is worked out with teaching values as a dominant criterion. The goal is to help the child see—visually and intellectually—what he is asked to learn.

Vocabulary control

The purpose of studying arithmetic is to learn how to solve quantitative problems. A vocabulary and general reading abilities are of course necessary. However, since the task of learning arithmetic is sufficiently difficult for the child, it is foolish to add extra burdens in the form of vocabulary and reading difficulties. For this reason the vocabulary of *Seeing Through Arithmetic 4* is carefully controlled.

In *Seeing Through Arithmetic 4* it is assumed that the children know only the 436 reading words (both arithmetical and general) that appeared in *Seeing Through Arithmetic 3.* These words are listed alphabetically on pages 344-345 of the *Teaching Guide* for *Seeing Through Arithmetic 3.* All other words are considered new words and are listed, for special attention by the teacher, at the beginning of the Lesson Briefs for each block of work. The total vocabulary of *Seeing Through Arithmetic 4* is 722 words. See pages 362-364 of this *Teaching Guide* for a complete alphabetical list of the words used.

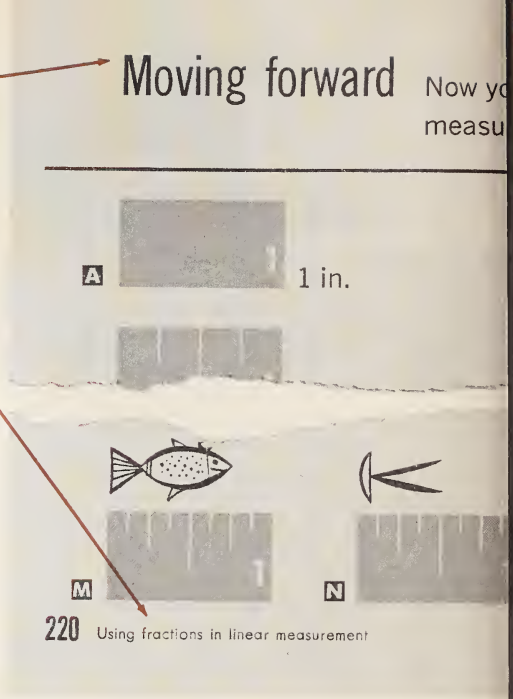

How many boxes of 10 cones are there? How many single cones are there?
Now you have tens and ones.
How many of the 10 cones should you take away? How many are left?
Subtract 9 ones from ones.
What does this 1 show?
How many boxes of 10 cones should you take away?
Now subtract tens from tens.
What does this 2 show?
Mary has pine cones.
50 − 29 = 21
34
Bob found 24 stones. He took 18 of them to science class and kept the others at home. How many stones did he keep at home?
24 − 18 =
Either remember them, follow, or write them.
39 − 17 =
82 − 36 =
60 − 42 =
55 − 21 =
The children drew 71 pictures of the plants and animals they saw in the woods. They put 35 of the pictures in a book. How many pictures were left over?
71 − 35 =
The science class had 40 pine cones. Sixteen cones were large, and the rest were small. How many small cones did the class have?
40 − 16 =
Ann found 54 nuts in the woods. She took 20 nuts to school and kept the others. How many did Ann keep?
54 − 20 =
There were 98 sheets of drawing paper sifted. The children began to draw. The children used 75 sheets. How many sheets were left?
98 − 75 =
73 − 67 =
67 − 32 =
87 − 37 =
80 − 28 =
96 − 52 =
64 − 9 =
45 − 29 =
69 − 40 =
41 − 18 =
70 − 46 =
63 − 55 =
74 − 45 =
65 − 20 =
91 − 8 =
86 − 51 =
95 − 15 =
73 − 43 =
50 − 37 =
44 − 37 =
96 − 44 =
90 − 24 =
66 − 25 =
71 − 64 =
42 − 19 =
27 − 19 =
73 − 21 =
93 − 49 =
80 − 71 =
87 − 43 =
52 − 34 =
37 − 18 =
68 − 28 =
Now you can subtract numbers of two figures.
35

Lesson headings

Seeing Through Arithmetic 4 uses headings that describe the nature of the various types of lessons. They serve to alert the child immediately as to the nature of the lesson—learning a new computational skill, practicing problem solving, maintaining skills, and so forth. In connection with these headings, there is, whenever necessary, a statement to the teacher (in small type opposite the page number) that gives a technical description of the content of the lesson. With some of these lessons, too, there is a statement opposite the heading that gives the child more information about the nature of the lesson.

These various types of lessons provide a wealth of material for the teaching of concepts, for practice, for maintenance, for review, and for testing achievement. Teachers who want suggestions on the varied uses of these materials will find them in the Lesson Briefs (pages 15-225) and in the Expanded Notes (pages 227-328) for each section. These materials provide the basis for effective lesson planning.

All material in *Seeing Through Arithmetic 4* is organized under nine headings:



Learning how	lessons using the four-step teaching method to develop or review computational skills
Exploring problems	lessons developing specific problem-solving techniques
Moving forward	lessons developing other new material, including basic facts, number system, money, fractions, and measurement
Using arithmetic	maintenance and practice in solving verbal problems
Keeping skillful	maintenance and practice in computation, measurement, number system, and money
Checking up	tests of various types: inventory, achievement, diagnostic (End-of-block), and problem-solving
Thinking straight	lessons involving special aspects of quantitative thinking
Looking back	lessons involving reteaching or review of previously taught content
Side trip	lessons on various topics related to the arithmetic program: Roman numerals, geometric figures, maps, etc.

Lesson briefs

This section of the *Teaching Guide* contains the aids that every teacher will need in using *Seeing through Arithmetic 4.* Collected together in one place for your convenience you will find:

Objectives

A very brief statement of the purpose of the lesson to help you see its relation to the program

Vocabulary

For each lesson a list of all words not used in preceding books of the program

Comments

Helpful information about the arithmetic itself and about methods of teaching

Answers

Answers for all exercises except basic facts and very simple items

Reproduced pages

A reproduction of each page from the pupil's book for your easy reference

Keyed notes

Brief directions for teaching each page, keyed by numbers to the reproduced page

Lesson briefs

A productive teaching situation includes interested children, an inspired teacher, and good materials. In using the materials of this program, do not forget the Expanded Notes on pages 227-328.

3-5 Moving forward

Expanded Notes for this lesson are on pages 229-233.

Objectives

The child reviews measures he learned in the first three grades. He becomes acquainted with various kinds of common measuring instruments. He learns the importance of scale. He learns correct habits of measuring.

Vocabulary

A vocabulary list like the one below is given in this *Teaching Guide* for each block of work in *Seeing through Arithmetic 4*. The list consists of words that are introduced in the book and are, therefore, new to this arithmetic program. Words marked with asterisks are already familiar to the children who have completed The New Basic Reading Program through The New *More Streets and Roads* (3/2). On pages 362-364 you will find a complete alphabetical list of all vocabulary.

New words **page 3** rulers, marks*; **page 4** length, end*, best*; **page 5** called*, scale, far*, easier*, might*, wrong*

Be sure to develop carefully the meaning of the word *scale* as applied to sets of calibrated marks and their numerals on measuring instruments.

Comments

If you have not already read the introduction to this *Teaching Guide*, you will want to do so before pro-

ceeding with these comments and the keyed notes. To use the *Teaching Guide* effectively, you should be familiar with the general aims and principles underlying this program. See pages 6-14.

The heading for this lesson, "Moving forward," indicates new material. The children are to read the sentence at the right of the heading. The description of the contents of the lesson, at the bottom of the page to the left of the page number, is for the teacher. The flag at the end of the lesson (at the bottom of page 5) is followed by a concluding statement about the lesson, which should be discussed with pupils before going on.

This lesson emphasizes the important aspects of measurement—the general concepts, techniques, and habits —not the measurement equivalents (12 inches = 1 foot). The child must understand what is meant by a standard unit and what a scale is. He must learn that a scale is always related to a standard, and that we use different scales to measure different things, such as temperature, time, and weight. He must eventually learn that all scales are alike in principle, and that many different units of measure can be represented on a linear scale. For this reason, careful development of the principles of the foot ruler is important. Page 3 shows some of the instruments used to measure different kinds of things and provides an opportunity to compare different kinds of scales.

The child must also learn the techniques of using measuring instruments correctly. He should begin to understand why good measuring habits are important, what bad measuring habits are, and why they are bad. Pages 4 and 5 show some of the ways in which rulers are marked and some of the correct and incorrect ways of using them. An understanding of measurement can be brought about best through concrete experiences. Various kinds of measuring activities should be used in the classroom, and the children should discuss and criticize one another's measuring procedures.

In using a foot ruler or yardstick, the child should be very much aware of the beginning point of the scale. Have available rulers that are marked in different ways. Let the child see that some of them have scales that start at the end, and others have a starting point a little distance from the end. Be sure he observes that on some rulers the numerals are beside the marks showing the scale, and on others they are above or below the marks. Avoid discussion of fractional parts of the inch.

You will find helpful additional material for the teaching of this lesson (and other lessons) in the section called Expanded Notes. Specific reference is made to this section at the beginning of each Lesson Brief.

Answers

The answers given here are representative of the kind of answers you might expect from the children. No particular wording should be insisted upon and no attempt should be made to use technical terms such as *parallel* for *straight*. For exercises like these the child's answer may be an explanation or discussion.

Page 4:

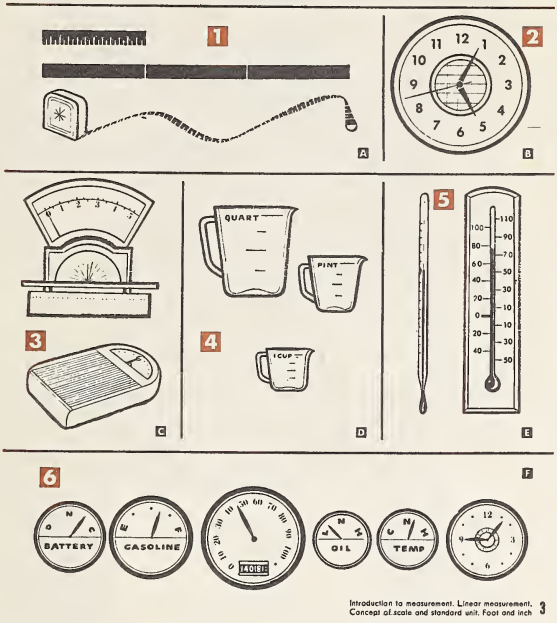
A Upper picture; stick is even with beginning point of ruler
B Inches
C 10 inches
D No
E The one that the arrow is pointing to; because it is the beginning point of the scale
F End point is marked with numeral "12," beginning point is not marked with a numeral; 12 inches
G 9 inches
H The child should indicate he realizes that the inches are not marked on this "ruler"
I In Picture C; because it is marked in inches

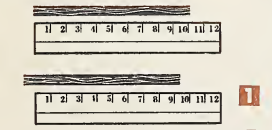
Page 5:

J 0 and 12 (Explain that 0 would have to be put at extreme left end of ruler)
K To 12 inches
L No; because its end is not placed at beginning point of ruler
M Place its end at beginning point of ruler
N When the end of the ruler is damaged, or the marks are worn off
O Yes (Encourage comparisons); people have agreed upon a certain measure of length as 1 inch
P No; he does not have the stick straight with the ruler
Q He is leaving a gap between the rulers

Moving forward

In this lesson you will learn more about measuring, and why rulers have marks and numerals on them.

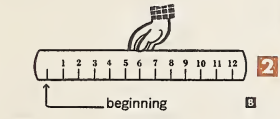




A Look at Picture A. Which is the correct way to measure the length of the stick? Why?

B What do the numerals on the ruler in Picture A show?

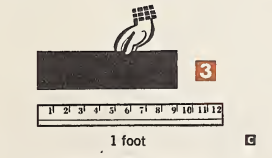
C How long is the stick in Picture A?



D Find the beginning point on the ruler in Picture B. Does it have a numeral? The numeral that could be put here is 0.

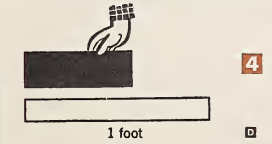
E If you were measuring a stick with the ruler in Picture B, which mark on the ruler would you put at one end of the stick? Why?

F How is the end point on the ruler in Picture B marked? How many inches are on this ruler?



G How long is the card in Picture C?

H How long is the card in Picture D?



I Which ruler can best be used to measure with, the one in Picture C or the one in Picture D? Why?

3

1 Let pupils talk about the pictures showing instruments that measure length. Have examples of as many as possible for the children to examine and use.

2 Discuss the various kinds of clocks, the different ways they are marked, and how we tell time. Discuss the use and relative motion of the hour, minute, and second hands.

3 Discuss the kinds of weight scales shown here and others the children have seen. Include the common spring or platform scales used in grocery stores.

4 Simply point out that we measure liquids in containers of this type. Liquid measurement will be developed later (pages 230-231).

5 Discuss the different types of thermometers the children have seen and their uses.

6 Talk about what is measured by the dials on an automobile dashboard. Bring out the idea that each dial has a scale.

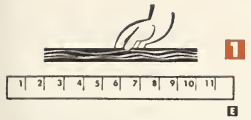
4

1 Have the children answer Question A. Use questions to bring out what is right and what is wrong in the two measuring situations. Have them answer Questions B and C.

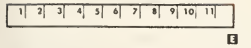
2 Have the children answer Question D. Get them to observe that sometimes there is no numeral at the beginning point of a ruler. Have them answer and discuss Questions E and F.

3 Get the children to observe that the numerals on the ruler in Picture C are to the left of each mark instead of above, as in Picture B. Have them answer Question G.

4 Have them answer Questions H and I. Discuss why we have inch marks and numerals on rulers. Get them to see that it is impractical to measure the card in Picture D with the ruler shown. Let them think of a way to measure the card with the ruler in Picture C (by marking a piece of paper the length of the card and measuring the paper).



1

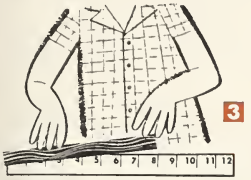


E

J Could any other numerals be put on Ruler E? What are these numerals? How do you know?

K The marks and numerals on a ruler are called a scale. How far does the scale on the ruler in Picture E go?

L Is the stick in Picture E 10 inches long? How do you know?



3

F

M What would be an easier way to measure the stick in Picture E?

N When might you want to use a ruler in the way shown in Picture E?

G

O Is 1 inch on your ruler the same length as 1 inch on any other ruler? How do you know? 2

P Is Don using his ruler correctly in Picture F? How do you know? 3

Q What is wrong with the way Don is measuring the table in Picture G? 4

Now you should be able to measure correctly with a ruler. 5

5

5

1 Have the children answer and discuss Questions J and K. Get them to observe that the stick in Picture E is not being measured in the usual way. Have them answer Question L. Let them discover that the measurement can be made by subtracting 2 from 10. Have them answer Questions M and N.

2 Have them answer and discuss Question O.

3 Picture F shows two errors in measuring. The stick is not held parallel with the edge of the ruler, and the end of the stick is not exactly at the end of the ruler. Be sure the children mention these two things when they answer and discuss Question P.

4 Have the children answer and discuss Question Q. Be sure they discover that the measurement in Picture G will be faulty.

5 Direct attention to the statement following the flag. Have a brief concluding discussion of correct and incorrect ways of measuring and the reasons why they are right or wrong.

6-7 Moving forward

Exponded Notes for this lesson ore on pages 233-236.

Objectives

The child learns about the measurement of weight, how a scale can be made, and more about a standard unit.

Vocabulary

New words page 6 weight, nothing*, bananas, moved*, sure*; page 7 where*, finish*

Comments

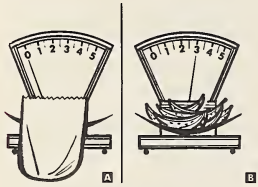
The child should learn that in the measurement of weight there must be a scale that begins at zero, and the indicator on the scales must point exactly to the zero mark before the object to be weighed is placed on the scales. The child must understand that this is similar to using a ruler with a precise beginning point (the zero point) and placing the beginning point precisely at the end of the object to be measured.

The child should also get a very clear idea of another instance of a standard unit and of how a scale is calibrated. Be careful to point out the difference between the meanings of the words *scale* and *scales*. The word *scale* is used to indicate the calibrated marks (and the numerals with them) used on any measuring instrument. The word *scales* is commonly used to designate an instrument for weighing objects. The plural form comes from the fact that originally objects were weighed by a system of balances, and two scales were involved.

If it is possible, provide one or more scales and cover the calibrated dials with cardboard, leaving only the starting point visible. Then let the children place the first few marks by the procedure shown on page 7. They should discover that the intervals between the marks are equal. Tell the children that the numerals on the scale in Picture D are on a wheel that turns inside the scales.

Moving forward

On pages 6 and 7 you will learn about how weight is measured and how weight scales are made.



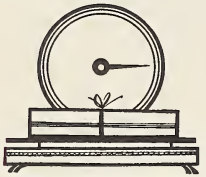
A

B

A How do you know that nothing is being weighed in Picture A?

B The same scales are shown in Picture B. Two things in this picture show that something is being weighed. What are they?

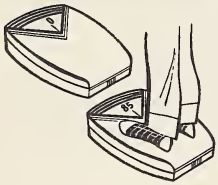
C In Picture B, to what numeral does the pointer point? The numerals here show pounds.



C

D When the bananas were put on the weight scales in Picture B, the pointer moved from 0 to 3. How many pounds do the bananas weigh?

E Do you know how much the package in Picture C weighs? Why or why not?



D

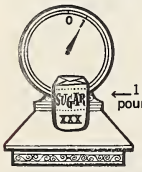
F Look at Picture D. How much does Tom weigh? Are you sure? Why or why not?

G A box of candy weighs 1 pound when weighed on the store scales. Should it weigh 1 pound when it is weighed on your scales at home?

6 Measurement of weight. Development of standard unit and scale in measurement of weight

E

H These three pictures show you how to put numerals and marks on weight scales. Picture E shows how you could begin. The little mark shows where the pointer is when there is nothing on the scale. Why is the numeral 0 put at this mark?



F

I Picture F shows that you have put something that you know weighs 1 pound on your scales. Where is the pointer now? Why is a mark put there? Why is the numeral 1 put at this mark?

J In Picture G another pound is on the scales. Where is the pointer now? Why is a mark put there? What numeral belongs at the mark?

G

K How would you finish putting the marks and numerals on your scales?

L How would you make a foot ruler that is to be marked in inches?

Now you should know how scales are used to measure weight.

6

1 Have the children answer Question A. Be sure they observe that the pointer is precisely at zero.

2 Have the children answer and discuss Questions B, C, and D.

3 Let the children give estimates of the weight of the package. Let them give reasons for thinking it weighs a certain amount, and then let them discover from the variety of estimates and reasons that it is impossible to tell. Help them see that weight scales are of no use unless they have a scale marked with numerals.

4 First let the children talk about the two views of the bathroom scales. Be sure they observe that the pointer on the empty scales is not exactly at zero. Discuss whether the boy on the other scales really weighs a little more or a little less than 85 pounds.

5 Have them answer and discuss Question G. Be sure they understand that an object should weigh the same on all scales.

7

1 Have the children answer and discuss Question H. Be sure they understand that the zero mark should be where the pointer points when there is nothing on the scales.

2 For Exercise I let the children talk about what has happened to the scales. Be sure they understand why the numeral 1 is put where it is.

3 Proceed in the same way for Picture G and Exercise J.

4 Discuss Question K and the way to continue by putting more pounds of sugar on the scales and making marks an equal distance apart.

5 Have the children answer and discuss Question L. Be sure they understand that the scale on a foot ruler is like the scale on a weight scales in principle. Ask them to tell how using weight scales is like using a foot ruler.

6 Direct attention to the statement following the flag and have a brief concluding discussion about the measurement of weight.

8-9 Moving forward

Expanded Notes for this lesson are on pages 236-238.

Objectives

The child learns how to read a Fahrenheit thermometer, and he learns what the freezing and boiling points of water are.

Vocabulary

New words page 8 thermometer, warm*, cold*, liquid, temperature, degrees; page 9 above*, below*, lowest*, worry*, cooking*, freezes, boils*, water*

Comments

One great difficulty the children will have with measuring temperature with a Fahrenheit thermometer is to understand the reason the zero point of the scale is where it is. It will be hard for them to understand why zero is not the freezing point.

Be sure the children understand that the liquid in the thermometer rises and falls as the temperature changes because the liquid expands when it becomes warmer and contracts when it becomes colder.

Let the children read a real thermometer. Let them discuss and, if possible, bring to class, different kinds of thermometers they have seen used (weather, fever, meat, candy, oven). Help them decide why the different kinds of thermometers have different ranges of possible temperature readings. Be sure they understand that on most thermometers each interval represents two degrees.

Answers

Page 9: A 94°; because each mark represents two degrees, not one degree; B Below 0°; because the liquid is below the 0 on the scale; C Above 0°; D 4° below 0; E 130°; F 120°, 140°, 130°; G 20° below 0, 30° below 0, 40° below 0; H Moves down the scale; I Yes; the scale goes from the coldest to the hottest temperatures we are likely to have; J No; there are no numerals on the scale; K Because the temperature is almost down to freezing, and his crops may be ruined; L Because many foods need cooking temperatures above 212°, the boiling point of water; M [C and D]; N Scales do not go to high enough temperatures

Moving forward

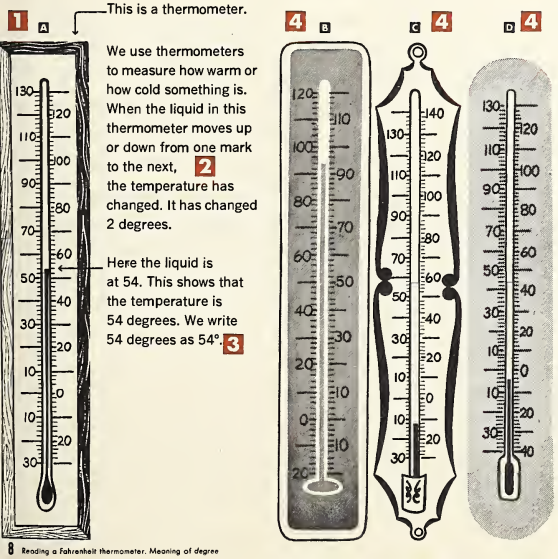
Pages 8 and 9 show you how to read a thermometer to find how warm or how cold something is.

1 A This is a thermometer.

We use thermometers to measure how warm or how cold something is. When the liquid in this thermometer moves up or down from one mark to the next, 2 the temperature has changed. It has changed 2 degrees.

Here the liquid is at 54. This shows that the temperature is 54 degrees. We write 54 degrees as 54°. 3

4 B 4 C 4 D



8 Reading a Fahrenheit thermometer. Meaning of degree

8

1 Direct attention to Thermometer A. Discuss the picture with the children. Be sure they know that the tube on the thermometer is filled with a liquid (which is usually colored red) and that the marks and numerals on the thermometer are a scale.

2 Have one of the children read the first paragraph at the right of the thermometer. Discuss the way the scale is marked and be sure they understand that each space represents two degrees. Ask them if they can think of a reason why each space should show two degrees instead of one (no room for more marks and numerals).

3 Have the children read this paragraph. Be sure they understand that we read a thermometer by looking at the mark nearest the top of the liquid in the tube. Ask them how they would read the thermometer when the top of the liquid is between two marks.

4 Discuss the differences in these thermometers.

A Does Thermometer B show a temperature of 94° or 92°? How do you know?

B Find 0° on Thermometer C. Is the temperature shown on Thermometer C above 0° or below 0°? How do you know? Thermometer C shows a temperature of about 12° below 0.

C Find 0° on Thermometers A and B. Are the temperatures shown on these thermometers above 0° or below 0°?

D Does Thermometer D show 4° below 0, 2° below 0, or 16° below 0?

E The marks and the numerals on a thermometer are the temperature scale. On Thermometer A the scale goes from 30 degrees below 0 to how many degrees above 0?

F What is the highest temperature that can be measured with Thermometer B? With Thermometer C? With Thermometer D?

G What are the lowest temperatures that can be measured with Thermometers B, C, and D?

H We use a thermometer to measure how warm or how cold the air is. As the air gets warmer, the liquid in the thermometer moves up the scale. What does the liquid do when the air gets colder?

E F Water freezes at 32° above 0. G Water boils at 212° above 0.

I Could the thermometers on page 8 be used to measure the temperature of the air? Why?

J Could you use Thermometer E above to measure temperature? Why?

K Why does a farmer sometimes worry about his plants on a day when the temperature is 35°? Picture F will help you.

L The scale on a thermometer used in cooking begins at a high temperature. Why? Picture G will help you.

M Which thermometers on page 8 show temperatures below freezing?

N Why would the thermometers on page 8 not be useful in cooking?

Now you should be able to read the thermometers in your home.

9

9

1 Discuss the questions in Exercises A to G. Be sure to refer to the thermometers on page 8. If possible, apply these questions to real thermometers provided by the children. Stress reading temperatures. Give special attention to the 2° intervals on the thermometers and to the need of counting *down* from zero.

2 Discuss the expansion and contraction of the liquid in connection with Question H.

3 In using Exercises I to N, stress the reasons for different scales. Be sure the children know what freezing and boiling temperatures are.

10 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child uses what he has learned about measurement on the preceding pages, reviews simple measurement equivalents, and practices comparing large and small units of measurement.

Vocabulary

New words page 10 honey*, jars*, ribbon*, string*

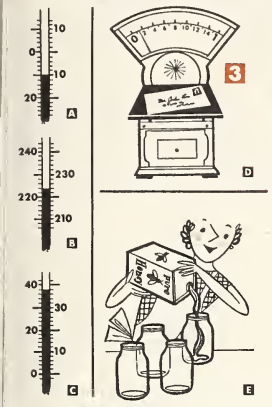
Comments

This lesson provides an opportunity for reviewing and practicing what was learned in the preceding lessons. These exercises should reveal any lack of understanding of the measures developed so far.

If possible, demonstrate the equivalent measures given in the table at the bottom of the page. Use both a foot ruler and a yardstick to show the relations among inch, foot, and yard. Various objects that weigh less than a pound (candy bars, bags of peanuts) can be compared in weight to give the children some concept of the ounce. If postal (letter) scales are available, paper and small objects can be weighed.

To develop an idea of the relative capacities of the pint, quart, and gallon, provide a vessel that holds each amount. Also provide a variety of cans and bottles of various capacities. Let the children estimate the capacity of each and then check their estimates by pouring sand, dried beans, or peas from the pint, quart, and gallon containers into them. They might also fill the cans and bottles and check their estimates by pouring the sand, beans, or peas into the pint, quart, and gallon containers.

Keeping skillful



1

1 foot = 12 inches
1 yard = 36 inches
1 yard = 3 feet
1 pound = 16 ounces
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 8 pints

2

A What temperature is shown on Thermometer A? On Thermometer B? On Thermometer C?

B Which thermometer shows the lowest temperature?

C Which thermometer shows the highest temperature?

D Do you think that the numerals on the scale in Picture D show pounds or ounces? Why?

3

4

E In Picture E, Mary's mother is putting a gallon of honey into quart jars. Does she have enough jars? How do you know?

F Which is more, a pound of candy or 14 ounces of candy?

G Which is longer, a ribbon 1 yard long or a ribbon 4 feet long?

H Which is less, 3 pints of milk or 1 quart of milk?

I Which is less, 30 inches of string or 1 yard of string?

J Which is more, 1 gallon of milk or 5 quarts of milk?

K Which is less, 20 ounces of candy or 1 pound of candy?

L Which is shorter, a ribbon 1 foot long or a ribbon 10 inches long?

10

1 Most children should know these equivalents. Have each child put a piece of paper over the units at the right of the equals signs. Then let the children take turns giving the equivalents. Next have each child cover the units at the left of the equals signs and give the equivalents.

2 Have the children answer Questions A, B, and C. Be sure to use Pictures A, B, and C.

3 Help children arrive at the correct conclusion about the scale units in Picture D. Discuss relative weights of such things as letters, stones, and sugar. The children will need help in understanding the dual use of the numerals on the scale, since the 1 stands for 1 pound (or 16 ounces) and not 1 ounce.

4 Permit the children to use the table of equivalents, if they need to, in answering Questions E to L.

11-15 Looking back

Expanded Notes for this lesson are on pages 239-243.

Objectives

The child reviews what he has learned about place value and the number system and about regrouping for carrying and borrowing.

Vocabulary

New words page 12 question*, no*

Comments

Understanding the decimal number system is an extremely important part of learning arithmetic. It is necessary not only in reading and writing numbers, but also in the processing of numbers by addition, subtraction, multiplication, and division.

There are two basic ideas that the child must grasp. One is that the same symbol—a one-figure numeral—may be used to represent ones, tens, hundreds, etc. The other idea is that we know what a symbol represents by its position with respect to other symbols in the numeral.

In previous grades the child worked with objects and pictures of objects. He assembled ones to make groups of tens, tens to make hundreds, and hundreds to make thousands. Then he learned to use tally marks to represent tens and ones, and to put them in proper places to indicate what they represent. Finally he learned to use numerals in place of the tally marks.

In reviewing the number system, you may find useful a collection of objects (sticks, pencils) that can easily be grouped by tens and hundreds. To avoid having to collect very many objects, have several boxes labeled "100" and several larger boxes labeled "1000." Tell the children to imagine that there are the right number of objects in each box. In each of the "100" boxes have one bundle of 10 objects that can be used for borrowing in subtraction. In each of the "1000" boxes have a bundle of 10 tens to be used for borrowing.

Many children have difficulty with computation because they do not understand the number system principles underlying carrying and borrowing. The regroup-

ing involved in these procedures should be taught in connection with the number system so that they can be applied when computation is taught.

Page 13 develops the regrouping that must be done for carrying in addition and multiplication. Page 14 reviews the regrouping for borrowing in subtraction. Page 15 provides exercises testing the child's understanding of the number system through four places. The number system is extended through millions on pages 126-128.

Answers

Page 12: H to J Accept any numeral that has 0 in the proper places; children may write larger numerals than those presented in this lesson.

Page 13:

A 6 hundreds, 7620	F 9 hundreds 8 tens	
B 3 thousands, 3469	G 1 hundred 8 tens 5 ones	
C 5 hundreds, 583	H 2 hundreds no tens 5 ones	
D 9 ones	I 9 tens no ones	
E 7 thousands		

Page 14:

A 14 ones	G 5 hundreds, 5 ones	M 14 ones
B 17 ones	H 12 hundreds	N 4 thousands
C 7 tens	I 3 thousands	O 10 hundreds
D 15 tens	J 19 ones	P 11 tens
E 2 hundreds	K 10 hundreds	Q 13 hundreds
F 13 ones	L 7 hundreds, 4 ones	R 8 thousands

Page 15:

(block 1)

A 68 B 303 C 72

(block 3)

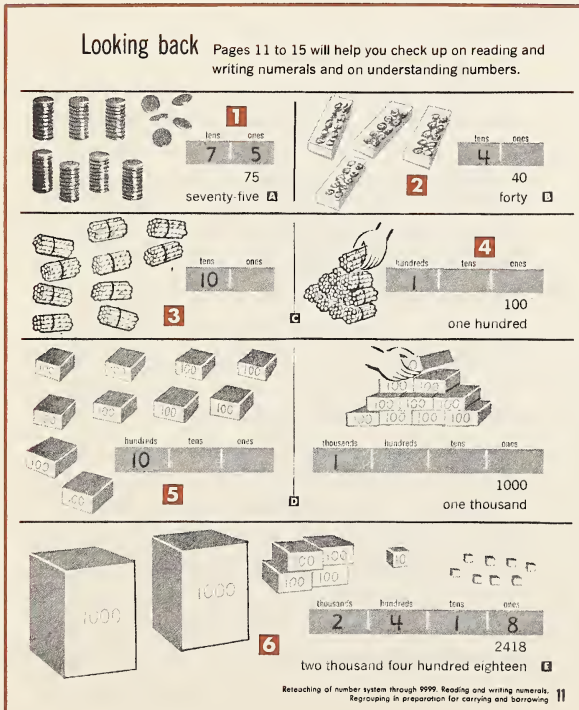
A 239	C 98	E 870	G 913
B 6040	D 4001	F 7152	H 1867

(block 4)

A 5 thousands 3 hundreds 9 tens 0 ones

B 0 thousands 5 hundreds 3 tens 9 ones

C thousands'	F hundreds'	I 17 tens	
D 0	G 2064	J 7 tens	
E 9	H 9007	K 10 tens	



11

1 Be sure pupils understand that there are 10 candies in each pile. Have them count the piles. Point out that the black 7 labeled "tens" stands for 7 piles of 10. Have them count the 5 single candies and note that the 5 in the ones' place stands for them. Direct attention to the numeral 75. Be sure they understand that the 7 stands for tens and the 5 for ones. The word *seventy-five* shows them what the numeral looks like when spelled out.

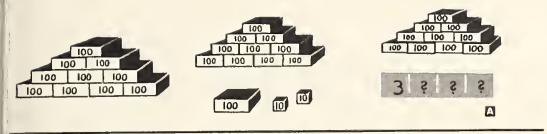
2 Use above procedures for Picture B. Be sure pupils understand why there is no numeral in the ones' place. Explain that the 0 in 40 is important to show that the 4 is in tens' place.

3 Emphasize that there are 10 bundles of ten.

4 Have pupils see that the 10 tens are being regrouped as one hundred and that a 1 is put in hundreds' place.

5 Adapt Procedures 3 and 4 for Movie D.

6 Have pupils use the picture to explain what each black numeral means.



A What numerals belong where the question marks are in each picture above? **1**

B In the number shown in Picture A the 3 is in what place? The 1 is in what place?

C In the number shown in Picture C the 5 is in what place?

D In which picture are there no ones? In which picture are there no tens?

E For which of these numbers is 4 in tens' place?

F For which of these numbers is 5 in hundreds' place?

G What number is shown in each picture?

A In 5078, the 5 is in what place? **2**

B In 647, the 7 is in what place?

C In 8091, the 0 is in what place?

D In 7840, the 4 is in what place?

E In 6139, what is in tens' place?

F In 2304, what is in thousands' place?

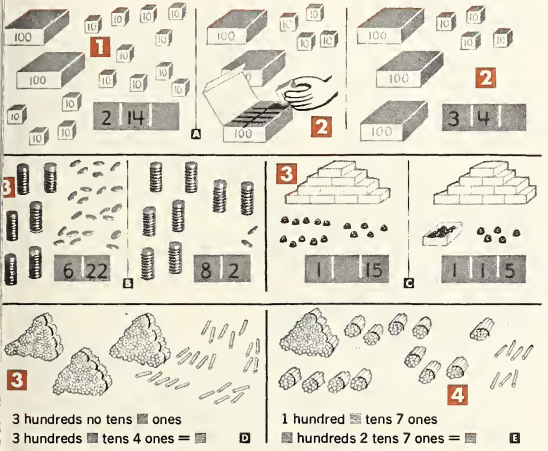
G In 1065, what is in hundreds' place?

H Write a numeral that has 0 in tens' place.

I Write a numeral that has 0 in hundreds' place.

J Write a numeral that has 0 in both tens' and ones' places.

2



3 hundreds no tens ■ ones
3 hundreds ■ tens 4 ones = ■ **D**

1 hundred ■ tens 7 ones
■ hundreds 2 tens 7 ones = ■ **E**

5

A 5 thousands 26 hundreds 2 tens no ones = ■ thousands ■ hundreds 2 tens no ones. The number is ■.

B 2 thousands 14 hundreds 6 tens 9 ones = ■ thousands 4 hundreds 6 tens 9 ones. The number is ■.

C 4 hundreds 18 tens 3 ones = ■ hundreds 8 tens 3 ones. The number is ■.

D 8 tens 19 ones = 9 tens ■ ones

E 5 thousands 23 hundreds = ■ thousands 3 hundreds

F 7 hundreds 28 tens = ■ hundreds ■ tens

G 18 tens 5 ones = ■ hundred ■ tens ■ ones

H 19 tens 15 ones = ■ hundreds ■ tens ■ ones

I 7 tens 20 ones = ■ tens ■ ones

12

1 Have the class answer Questions A to G in the first column. Each of these questions relates to the pictures at the top of the page, and they should be discussed and answered orally. Work with the children in much the same way that you did on page 11. Be sure that each child in the class has a chance to respond at least once.

2 Exercises A to J in the second column do not relate to the pictures. Have the children write the letters A to J on their papers, and then write the answer to each question beside its letter. When they have finished, the answers may be read aloud and discussed.

13

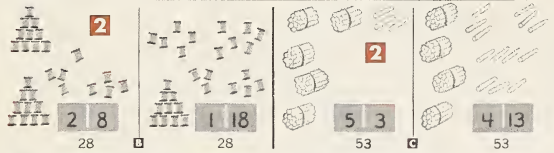
1 Direct attention to Movie A. Have the children note that the first scene shows 2 hundreds and 14 tens. Let them explain the black numerals. Bring out by discussion of the second scene that 10 of the 14 tens are being put into a box to make another hundred, and that there are 4 tens left over. The third scene shows the new arrangement as 3 hundreds and 4 tens. Let the children explain the black numerals. Be sure they read the number as 340.

2 Point out that the single objects in the first scene can be regrouped to make tens, and that in the second scene this has been done. Relate the black numerals to the pictures.

3 Ask the children what should be done with the ones. Relate the first statement to the picture as it is and the second statement to the picture as it will be when the ones are regrouped.

4 Adapt Note 3 to Picture E.

5 Do Exercises A to I orally.



4

A 94 = 8 tens ▢ ones
B 27 = 1 ten ▢ ones
C 82 = ▢ tens 12 ones
D 256 = 1 hundred ▢ tens 6 ones
E 360 = ▢ hundreds 16 tens
F 503 = 4 hundreds 9 tens ▢ ones
G 645 = ▢ hundreds 14 tens ▢ ones
H 7200 = 6 thousands ▢ hundreds
I 4100 = ▢ thousands 11 hundreds
J 909 = 8 hundreds 9 tens ▢ ones
K 3000 = 2 thousands ▢ hundreds
L 864 = ▢ hundreds 16 tens ▢ ones
M 864 = 7 hundreds 15 tens ▢ ones
N 5500 = ▢ thousands 15 hundreds
O 7000 = 6 thousands ▢ hundreds
P 910 = 8 hundreds ▢ tens
Q 6300 = 5 thousands ▢ hundreds
R 9700 = ▢ thousands 17 hundreds

A What number is shown in Picture A?
B What number is shown in Picture B?
C What number is shown in Picture C?

1

Read **2**

A	38	308	378	3008	3078	3780	3781
B	50	502	512	5120	5026	5260	5269
C	85	805	835	8005	8050	8650	8652

Write the numerals. **3**

A two hundred thirty-nine
B six thousand forty
C ninety-eight
D four thousand one
E eight hundred seventy
F seven thousand one hundred fifty-two
G nine hundred thirteen
H one thousand eight hundred sixty-seven

A 5390 = ▢ thousands ▢ hundreds ▢ tens ▢ ones
B 539 = ▢ thousands ▢ hundreds ▢ tens ▢ ones
C In 8601, the 8 is in what place?
D In 502, what is in tens' place?
E In 7769, what is in ones' place?
F In 1624, the 6 is in what place?
G 2 thousands no hundreds 6 tens 4 ones = ▢
H 9 thousands no hundreds no tens 7 ones = ▢
I 672 can be 5 hundreds ▢ tens 2 ones.
J 83 can be ▢ tens 13 ones.
K 904 can be 8 hundreds ▢ tens 4 ones.

4

Now you should be able to read and write any numeral from 1 to 9999.

14

1 In the first scene have the children note the groups of hundreds, tens, and ones, and how they are represented in the tally box. Ask someone to read the number, 425. In the second scene point out that one of the groups of one hundred is broken up into tens. In the third scene the children see the regrouping completed. Have them read the numerals in the box as 3 hundreds, 12 tens, and 5 ones. Be sure they see why this is the same as 425.

2 Point out that one of the tens in the first scene is regrouped as 10 ones in the second scene. Relate the numerals in the tally boxes to the pictures.

3 Let the children explain the regrouping required by the second line of text. Be sure they observe that the regrouping on this page consists of breaking up large groups into smaller groups, and that this is the opposite of what was done on page 13.

4 Do Exercises A to R orally.

15

1 Direct attention to these three exercises and the pictures. Let each child make a tally box for the numerals as pictured and also a box for the numerals for the regrouped objects.

2 Direct attention to the exercises under "Read." Call on the children in random order and have them read the numbers aloud. Be sure each child responds at least once. Encourage the children to find such numbers in books and newspapers.

3 Ask the children to write the letters A to H on their papers and then write the correct numeral opposite each label.

4 This exercise can be done either orally or in writing, depending on the needs of the class.

16 Looking back

Exponded Notes are not considered necessary for this lesson.

Objectives

The child reviews what he has learned about combining actions and separating actions. He learns the difference between additive actions and multiplicative actions and between subtractive actions and divisive actions.

Vocabulary

New words page 16 join*

Comments

In Grade 2 the child began learning about the combining and separating actions which develop the meanings of the four fundamental processes. He learned that in additive situations he should think of one group as joining another, and that these groups do not have to be equal in size; that in subtractive situations part of the group is taken away from the whole group, and that we are concerned with the part that remains. He learned that in multiplicative situations groups of equal size join; no one of them joins the others, but all come together at once. He learned that in divisive situations the group breaks apart into equal groups, and none of these groups is necessarily taken away. Great care should be taken to see that the children understand the differences among these situations. It is very important that they do not confuse additive and multiplicative action, that they know that in multiplicative actions the equality of the groups is essential. Similarly, they should not confuse subtractive and divisive action, and they should understand that in divisive actions also the equality of the groups is essential. If necessary, use objects to make these actions real and the differences between them clear.

16 Review of combining and separating actions

16

1 First let the children look at all of the pictures to decide which ones show groups separating and which ones show groups combining.

2 Let the children answer questions like these about this picture: "How many groups are there? Are the groups equal? What is happening? How many animals (birds, squirrels, butterflies) will there be in all?"

3 Let the children answer questions like these about this picture: "How many animals are there to begin with? Is one group going away, or are they all going away in equal groups?"

4 Ask the children to make a problem about each picture.

17 Checking up

Expanded Notes for this lesson ore on pages 244-245.

Objectives

The child tests his knowledge of the addition basic facts.

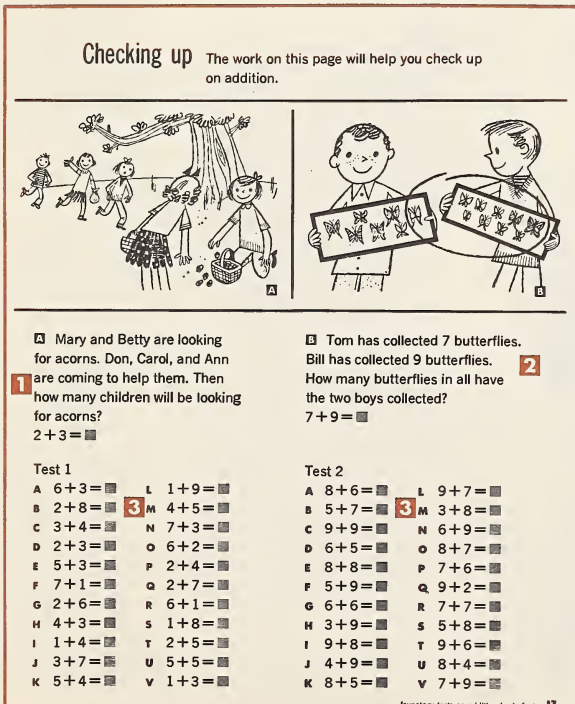
Vocabulary

New words page 17 addition, collected*

Comments

In this book the lessons called "Checking up" are always tests. Page 17 provides two inventory tests on the addition basic facts. Test 1 is on the basic facts with sums of 10 or less. Test 2 is on those with sums exceeding 10. The purpose of these tests is to reveal any general weakness on the part of the children in their knowledge of the addition basic facts. If children do not respond correctly on *all* of the items in each test, some further work on the addition basic facts is needed. Since these facts were taught in Grades 2 and 3, the best reteaching materials are the lessons in the books for those grades. In any case, take definite steps to reteach children who show weaknesses. (See Teaching Guides for Grades 2 and 3.) It is important to arouse the children's interest and enthusiasm in improving their knowledge of the basic facts. Let them keep a list of the facts that are causing them trouble and cross off each fact as it is learned. Encourage them to eliminate all the facts on the list as quickly as they can.

The pictures are intended to review the two types of additive situations that lead to addition basic facts. Picture A shows real action, and Picture B shows imagined action, in which the child must imagine the two groups as one.



Checking up The work on this page will help you check up on addition.

A

B

1 A Mary and Betty are looking for acorns. Don, Carol, and Ann are coming to help them. Then how many children will be looking for acorns?
2+3=■

2 B Tom has collected 7 butterflies. Bill has collected 9 butterflies. How many butterflies in all have the two boys collected?
7+9=■

Test 1

A	6+3=■		L	1+9=■
B	2+8=■	3	M	4+5=■
C	3+4=■		N	7+3=■
D	2+3=■		O	6+2=■
E	5+3=■		P	2+4=■
F	7+1=■		Q	2+7=■
G	2+6=■		R	6+1=■
H	4+3=■		S	1+8=■
I	1+4=■		T	2+5=■
J	3+7=■		U	5+5=■
K	5+4=■		V	1+3=■

Test 2

A	8+6=■		L	9+7=■
B	5+7=■	3	M	3+8=■
C	9+9=■		N	6+9=■
D	6+5=■		O	8+7=■
E	8+8=■		P	7+6=■
F	5+9=■		Q	9+2=■
G	6+6=■		R	7+7=■
H	3+9=■		S	5+8=■
I	9+8=■		T	9+6=■
J	4+9=■		U	8+4=■
K	8+5=■		V	7+9=■

Inventory tests on addition basic facts 17

17

1 Have the children read this problem and refer to the picture. Let them discuss the action of one group joining another. Direct attention to the equation. Be sure they can tell what each figure in the equation stands for.

2 Have the children read this problem and refer to the picture. Help them conclude that the two groups are not to be put together, but that they must be imagined as one group. Draw attention to the ring around 10 butterflies and help the children see the whole group as 10 and 6, or 16.

3 Have the children write the letters A to V on their papers and then write the sum for each equation on the correct line. When they have finished, read the answers and have them mark each error. Give special help to any child who needs it before going on.

18-19 Learning how

Expanded Notes for this lesson are on pages 245-247.

Objectives

The child reviews the addition of three or more one-figure numbers.

Vocabulary

New words page 19 woods*, brought*, bring*

Comments

In adding a column of figures, children learn to look at the first two numbers and to think the answer (which should come to mind immediately because a basic fact is involved). They learn to keep this number in mind as they look at the next number and decide whether these two numbers, added together, will give them an answer in the same decade or the next decade. Then they determine how many ones there are. They learn to do this quickly as they add a column of figures.

The number they must keep in mind changes as they go down the column, as does the number that they must add to it, which they see on the paper. Although it does not matter whether children add up or down a column, for purposes of consistent presentation of new material in this book, all adding is begun at the top of the column.

Children should be able to compute mentally when adding three or more one-figure numbers. Therefore, they should be able to add when the example is given in equation form. For written assignments, however, they may write the figures in column arrangement.

This lesson serves as an introduction to the built-in four-step teaching method that is used throughout this program to develop all new computational skills. Steps are provided to help the child SEE (by means of illustrations and explanations), THINK (by means of illustrations and questions), TRY (by means of problems and examples worked out with answers for comparison), and DO (by means of practice material without guidance) in learning how to add a column of one-figure numbers. Special material is provided in the book for each of the four learning steps.

These four steps are based on a teaching method that many successful teachers use consistently in presenting new material on the board. Here the steps are systematically employed and are implemented by pictures, explanations, questions, examples, and problems. The SEE and THINK steps are intended to be taught under the direct guidance of the teacher with the aid of the book. The TRY and DO steps are intended to be used independently by pupils. They also provide a means for taking care of individual differences in pupils. The teacher should work with those who need assistance in the TRY step at the time when they most need it. The better students may try as many problems or examples of the TRY step as they need, then go immediately to the DO step.

The SEE step for this lesson appears on page 18. Note that the pictures show clearly what each computational step means. Note, too, that the portions of each picture not of direct concern at the stage of solution under discussion are dimmed. (See the 6 dimmed acorns in Picture B.) Children need to focus only on the undimmed portions. Also for emphasis, figures that are under discussion in the computational forms are black. The THINK, TRY, and DO steps are on page 19.

The explanations and questions in the book do not provide everything that might be said in teaching the material. You are expected to fill in, teaching from the structure provided. You will strengthen the lesson greatly if you use objects to demonstrate what the pictures show.

Answers

Page 19:

A 20	D 17	G 21	J 19	M 18	P 11
B 8	E 23	H 21	K 23	N 23	Q 30
C 9	F 18	I 22	L 14	O 22	

Learning how

This lesson will help you remember how to add numbers that have one figure.

see

Mary found 7 acorns. Ann found 8 acorns. Betty found 6 acorns. How many acorns did the girls find? 1

$7+8+6=\square$ You must find this number. 3

A

First put 8 acorns with 7 acorns. 4

B

7
8 ← First add 8 to 7. Remember the 15. 5
6

Now put the 6 acorns with the 15 acorns.

C

7
8
6 ← Now add 6 to the 15 that you remember. 7

The girls found 21 acorns in all.

D

7
8
6
21 ← Write 21 here. 21 is the sum. 9

$7+8+6=21$

8

think

How many butterflies are there in all? 1

$2+4+7+3=\square$ You must find this number.

2
4
7
3
16

What numbers do you add first?
What do you add next?
What do you add last?
What is the sum? 2

There are ▢ butterflies in all.

try

A $6+9+2=17$	E $3+1+8=12$	I $7+7+9=23$
B $5+4+7=16$	F $3+8+2+8=21$	J $8+4+3+7=22$
C $5+2+6+5=18$ 3	G $9+7+8=24$	K $2+1+8+5=16$
D $7+6+4=17$	H $2+9+1+8=20$	L $5+8+8+3=24$

do

A In the woods Betty counted 5 birds, Bill counted 7 birds, Mary counted 3 birds, and Don counted 5 birds. The children counted how many birds in all? 4

$5+7+3+5=\square$

B The children brought plants to school. Tom brought 3 plants, Carol brought 2 plants, and Ellen brought 3 plants. How many plants in all did they bring? 4

$3+2+3=\square$

C $4+2+3=\square$	H $6+1+5+9=\square$	M $4+1+5+8=\square$
D $7+2+8=\square$	I $8+7+7=\square$	N $7+7+6+3=\square$
E $2+6+6+9=\square$	J $2+9+3+5=\square$	O $7+6+9=\square$
F $6+7+5=\square$ 5	K $5+6+4+8=\square$	P $5+1+3+2=\square$
G $9+1+4+7=\square$	L $3+3+8=\square$	Q $8+9+7+6=\square$

Now you should know how to add numbers that have one figure. 6

18

1 Have the pupils read the problem only.
2 Ask a pupil to identify a pile of acorns in the picture with each girl named in the problem.
3 Ask a pupil to read this equation and sentence.
4 Let a pupil read the sentence introducing Picture B and note the action shown.
5 Have pupils examine the column of numerals and compare them with the equation above. Explain that the black numerals stand for the objects being worked with in the picture. Discuss the addition of 7 and 8.
6 Have pupils look at the picture and the sentence belonging to it. Ask, "What is happening?"
7 Direct attention to the computation. Ask: "What does the 6 stand for? Why do you add it to 15?" Ask children why the answer will be in the twenties and not the "teens."
8 Be sure the pupils observe the sum and compare it with the acorns shown in the picture.
9 Have them compare this equation with the one at the top of the page.

19

1 Have pupils make a problem for the picture. Then direct attention to the equation.
2 Let children read and answer the questions. Then let them add the column, following the procedure outlined by the questions.
3 Have the pupils take turns doing these exercises orally. Then have them write the examples in computational form and find the answers.
4 Ask a pupil to read this problem and the equation. Let another child write the figures in a column on the board and add them orally.
5 Have the pupils take turns finding the answers orally. Then direct the children to add and write the answers on paper, labeling each with its identifying letter. You may require them to write the examples in computational form with answers.
6 Ask a pupil what the class has learned in the lesson and let him read the closing statement.

20-23 Learning how

Expanded Notes for this lesson are on pages 247-248.

Objectives

The child reviews the addition of any two or three numbers that have two figures.

Vocabulary

New words page 21 John*; page 23 Peggy, class, feeding*

Comments

This lesson reteaches the addition of numbers with two figures. It gives fourth-graders who may have forgotten how this is done a chance to learn again.

The first problem children meet in learning to add numbers with two figures is that of carrying. They are taught to add the ones first. The two-figure number they get as an answer they already think of as composed of a ten and so many ones. They learn to write the number of ones in ones' place and to put the ten with the other tens, as they did when studying the regrouping of tens and ones in an earlier lesson on the number system. Then they add the tens and write that number in tens' place. Not until they have studied and tried some problems and examples involving carrying of this type do they meet an example involving the addition of two-figure numbers without carrying.

Addition is begun with carrying so that the child gets at the very beginning a general idea of the process of addition. He begins by focusing on the relation between the columns. When addition without carrying is taught first, this important relation is apt to be ignored by the pupil, and this leads to confusion later.

The use of pictures to show the steps used in adding the numbers makes it possible for even slow learners to succeed with addition. Futhermore, the pictures remove the special difficulties involved with zeros in the rote methods often used.

The complete lesson treatment of four pages makes use of the four-step teaching method.

The SEE step begins on page 20 and ends on page 21. Note that the pictures show clearly what each computational step means. Note, too, that the portions of each picture not of direct concern at the stage of solution under discussion are dimmed. Children need to focus only on the other portions. Note, also, that the numerals under consideration in the computation are printed in black.

The THINK step begins on page 21 and ends on page 22. Pictures again carry the brunt of the teaching. The TRY step appears at the top of page 23. The DO step appears at the bottom of page 23 and includes an extra set of exercises for those who need more practice. This extra set will be provided hereafter in all DO steps in blocks of work entitled "Learning how."

The explanations and questions in the book do not provide everything that might be said in teaching the material. You are expected to fill in, teaching from the structure provided. You will strengthen the lesson greatly if you use objects to demonstrate what the pictures show.

Answers

Page 23:

(block 1)			(block 2)	
A 62	F 97	K 99	A 94	D 80
B 27	G 85	L 93	B 96	E 130
C 98	H 140	M 173	C 94	F 188
D 88	I 74	N 161		
E 63	J 88			

Learning how

This lesson will help you remember how to add numbers that have two figures.

see

A

Ann has 56 shells. Betty has 38 shells. The girls have how many shells in all?

1 $56+38=\square$ You must find this number.

B

Put 8 shells with 6 shells.

Add the ones. There are 14 ones.

$$\begin{array}{r} 56 \\ 38 \\ \hline \end{array}$$ 2 3

C

Put 10 of the 14 shells in a box. You have 4 shells left over.

$$\begin{array}{r} 56 \\ 38 \\ \hline 4 \end{array}$$ 4

14 is 1 ten 4 ones. 5

Write 4 here to show there are 4 ones in the answer.

D

Put the new box of 10 with the other boxes of 10.

$$\begin{array}{r} {\scriptstyle 1} \\ 56 \\ 38 \\ \hline 4 \end{array}$$ 6

Write the ten in tens' place.

E

Put the boxes of 10 together.

$$\begin{array}{r} {\scriptstyle 1} \\ 56 \\ 38 \\ \hline 94 \end{array}$$ 1 2

Add the tens. There are 9 tens.

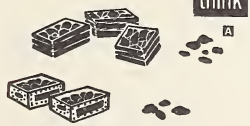
Write 9 here to show there are 9 tens in the answer.

F

The girls have 94 shells in all.

$56+38=94$ 3

think



A

John has 36 stones. Bill has 24 stones. The two boys have how many stones in all?

4

$36+24=\square$ You must find this number.

B

What do you put together first?

What do you add first? How many ones are there?

$$\begin{array}{r} 36 \\ 24 \\ \hline \end{array}$$ 5

Now turn the page.

20

1 Have pupils read the problem. Tell them to look at Picture A to "see" the problem situation. Have them point to Ann's shells; then to Betty's. Ask them what they are to find in the problem. Have them write the equation for it on the board.

2 Have children observe that the single shells are being put together.

3 Now direct attention to the computation. Compare the numbers with those in the equation above. Explain that the black figures stand for the single shells that are being put together and that they must add these numbers.

4 Let the children observe that the 14 shells are being made into a box of 10 and 4 single shells left over.

5 Be sure they think of the 14 as 10 and 4 and that they think of the 4 in the answer as standing for the 4 single shells.

6 The children should understand that the black 1 that is "carried" stands for the new box of 10.

21

1 Have children observe that all of the boxes of 10 are being put together.

2 Explain that we are now working with the numerals that stand for the boxes of 10 shells. Be sure the children add. Compare the 9 tens in the answer with the boxes in the picture.

3 Ask pupils to read the statement. Then have them look at the equation. Tell them it is the one they made when they first read the problem, but that now it contains the missing number.

4 Tell pupils that with this problem the only help they will get in the book is questions to help them think. Have them read the problem first, look at the picture, and then make the equation.

5 Have them read the first question and use the picture to answer it. Then have them read the questions about the example and answer them.

C

What do you do with the 10 stones?

1

36
24
0

Think of the 10 ones as ■ ten.

Why do you write 0 here?

D

What do you do with the new box of 10?

2

1
36
24
0

Why is the 1 written here?

E

What do you put together now?

3

1
36
24
60

What do you add now?
How many tens are there?

What does the 6 show?

F

The boys have ■ stones in all.

36 + 24 = ■ 4

try

A Mary found 23 nuts in the woods. Peggy found 14 nuts. Ellen found 22 nuts. How many nuts in all did the girls find?
23 + 14 + 22 = ■ 1

23
14
22
59

B Dick collected 19 leaves, and Don collected 15 leaves. The two boys collected how many leaves?
19 + 15 = ■ 1

1
19
15
34

Either remember this ten or write it.

C 70 + 56 = ■

D 29 + 7 + 59 = ■

E 63 + 58 + 21 = ■ 2

70
56
126

Why do we write 1 in hundreds' place?

29
7
59
95

63
58
21
142

do

A In the woods one class counted 28 birds, and the other class counted 34 birds. How many birds did the two classes count?
28 + 34 = ■ 3

B Fifteen birds were feeding on the ground in the woods. Twelve more birds flew down to feed. Then how many birds were feeding?
15 + 12 = ■

G 73 + 7 + 18 = ■
D 32 + 56 = ■
E 12 + 51 = ■
F 68 + 29 = ■
C 47 + 38 = ■
H 90 + 50 = ■

I 50 + 24 = ■
J 49 + 39 = ■
K 4 + 57 + 38 = ■
L 13 + 28 + 52 = ■
M 42 + 56 + 75 = ■
N 66 + 71 + 24 = ■

A 57 + 37 = ■
B 41 + 17 + 38 = ■
C 9 + 65 + 20 = ■
D 45 + 35 = ■
E 29 + 47 + 54 = ■
F 82 + 76 + 30 = ■

Now you should be able to add any numbers with two figures in them.

22

1 Pupils should see that Picture C shows the answer to the first question. Direct attention to the example and be sure they add the ones. Have them answer the question about why the 0 has been written. (There are no ones, as shown in Picture C.)

2 Have pupils read the first question opposite Picture D and look at the picture to see the action carried out. Have them read the second question and refer to the picture in answering it.

3 As the children study this picture and the work opposite it, be sure they relate the numerals to the objects in the picture. Be sure they add and that they understand that the addition they do (of the tens) is shown with action in the picture. Take special care to see that they think of the 6 in the answer as 6 tens and of the boxes in the picture as 6 boxes of 10.

4 Have pupils read the statement and equation opposite Picture F, saying the missing numbers.

23

1 Have pupils do this problem as written work. Tell them that in doing the problem they should read it, make the equation, write the numerals in computational form, and compute to get the answer. Afterwards, they should compare their work with the equation and computation provided in the book to find if they were right or wrong, and, if wrong, where they went astray.

2 For Examples C to E, tell pupils they should write the figures in computational form and compute. Then they should compare their work with that shown in the book. Some of the children may need help from you as they go along.

3 Tell pupils that they get no further help from the book with these problems and examples. Have them write the problems and examples in computational form and find the answers. Afterwards, discuss the problems and examples.

24-27 Learning how

Expanded Notes for this lesson are on pages 248-249.

Objectives

The child reviews the addition of three-figure numbers with carrying.

Vocabulary

New words page 27 pine, cones

Comments

This lesson gives the child an opportunity to recall how he adds numbers with three figures. The lesson covers four pages, and the four-step method is used in teaching the lesson. See the Lesson Briefs for the preceding two lessons for an explanation of this method.

The addition of two or more three-figure numbers uses the same principles of regrouping within the framework of the number system that the preceding lesson with two-figure numbers did. The only new thing involved is the use of the carrying technique twice in the same example. The first example involves carrying twice. Since the child has already reviewed adding two-figure numbers, he knows how to change ones to tens. He must now change tens to hundreds.

In the SEE step, found on pages 24 and 25, illustrations and written explanations make each computational step thoroughly clear. In the THINK step on page 26, illustrations and questions help children think their way through the procedures to the answer. The TRY and DO steps on page 27 offer exercises for practice. The TRY step supplies worked-out examples. The DO step includes examples for independent work.

Answers

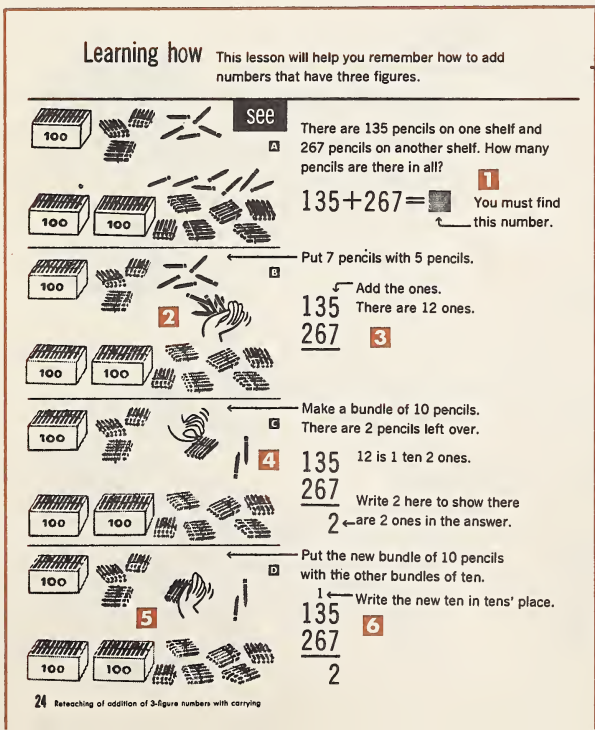
Page 27:

(block 1)

A 198	E 252	I 528	M 741
B 447	F 587	J 469	N 599
C 831	G 270	K 806	O 1032
D 800	H 931	L 803	P 219

(block 2)

A 878	E 1359
B 900	F 2029
C 932	G 2204
D 664	


Learning how
This lesson will help you remember how to add numbers that have three figures.
see
There are 135 pencils on one shelf and 267 pencils on another shelf. How many pencils are there in all?
135+267=■
You must find this number.
Put 7 pencils with 5 pencils.
Add the ones.
There are 12 ones.
135
267
Make a bundle of 10 pencils.
There are 2 pencils left over.
12 is 1 ten 2 ones.
Write 2 here to show there are 2 ones in the answer.
Put the new bundle of 10 pencils with the other bundles of ten.
Write the new ten in tens' place.
24 Reteaching of addition of 3-figure numbers with carrying

24

1 Have the pupils read the problem and the equation. Ask them to look at Picture A. Be sure they identify each number with its group of objects.

2 Have the pupils observe that the ones are being put together. They should be told to ignore the part of the picture that is dimmed off.

3 Now direct attention to the computation and relate the black numerals to the groups involved in the action in the picture. Ask, "Does adding 7 to 5 go with what is happening?"

4 Have a child tell what is being done in Picture C. Then have him think of the sum of 5 and 7 as 1 ten and 2 ones. Ask: "What shows this in the picture? How are the pencils for the 2 in the answer shown?"

5 Get the pupils to observe that the new bundle of 10 is being put with the other tens.

6 Draw attention to the black 1 and relate it to the bundle in the picture. Ask, "Why is this 1 put in tens' place?"

Now put the bundles of 10 together.

E

Add the tens.
There are 10 tens.

```
 1
135
267
---
  2
```

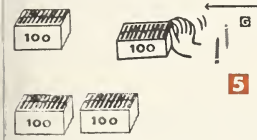
Put the 10 tens in a box of 100.

F

10 tens equal 1 hundred.

```
 1
135
267
---
 02
```

Write 0 here to show there are no tens in the answer.



Put the new box of 100 with the other hundreds.

G

Write the new hundred in hundreds' place.

```
 1 1
135
267
---
 02
```

Put the boxes of 100 together.

H

Add the hundreds.
There are 4 hundreds.

```
 1 1
135
267
---
402
```

Write 4 in hundreds' place.

135 + 267 = 402
There are 402 pencils in all.

think

There are 126 pencils, 209 pencils, and 83 pencils. How many pencils are there in all?

A

126 + 209 + 83 = ▒ You must find this number.

What do you add first?
How many ones are there?

```
126
209
 83
---
  8
```

Why do you write 8 here?

B

```
 1
126
209
 83
---
 18
```

Why is 1 written here?
What do you add now?
How many tens are there?

What does this 1 show?

C

```
 1 1
126
209
 83
---
418
```

Why was 1 written in hundreds' place? Now what do you add?
How many hundreds are there?

Why do you write 4 here and not 3?

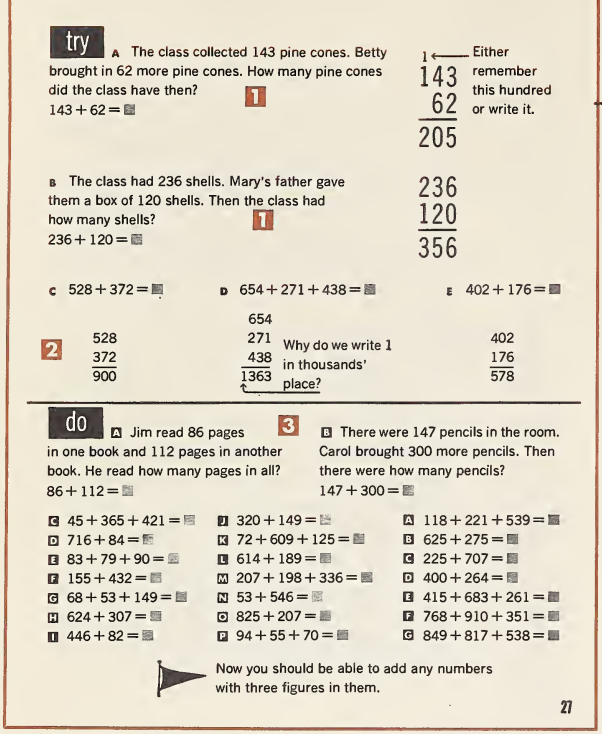
There are ▒ pencils in all.
126 + 209 + 83 = 418

25

1. Draw attention to the combining of the bundles of 10. Ask, "How many tens are there?"
2. Now study the computation. Ask: "What does each black figure stand for? How does the picture show what adding them means?"
3. Be sure the pupils know that there are 10 tens. Then let them explain what is being done with them.
4. Ask: "Why do we write 0 in the answer? How does the picture show that 0 is correct for tens' place?"
5. Ask questions to get the pupils to see that the black 1 stands for the new box of 100 and that putting it in hundreds' place is similar to putting the new box with the other boxes of 100.
6. Let one child explain the picture.
7. Let another child add the hundreds orally.
8. Be sure the children understand what part of the picture each numeral in the answer stands for. Relate the equation to the one at the beginning and to the problem.

26

1. Tell the pupils that in the THINK step they will have questions to guide them, but they will have to do their own thinking. Direct attention to the problem, the equation, and Picture A.
2. Study this example with the children. Direct attention to the black numerals. Then ask: "Which objects in Picture A do they stand for? What do we do with these objects? With the numbers?" Be sure they think of the sum as a ten and 8.
3. Let the children discover that there is a new bundle of 10 in Picture B. Let them add the tens. Be sure they think of the sum as 1 hundred and 1 ten. Discuss the 1 in the answer.
4. Look at Picture C. Ask, "What has been done with the 10 tens?"
5. Look at the example. Ask: "What was done with the 1 hundred left over from the tens? How do you get 4 in the answer?"
6. Check the answer with Picture C.



try

A The class collected 143 pine cones. Betty brought in 62 more pine cones. How many pine cones did the class have then? 1
143 + 62 = ■

1 ← Either remember this hundred or write it.

143
62
205

B The class had 236 shells. Mary's father gave them a box of 120 shells. Then the class had how many shells? 1
236 + 120 = ■

236
120
356

C 528 + 372 = ■

D 654 + 271 + 438 = ■

E 402 + 176 = ■

2

528
372
900

654
271
438
1363

Why do we write 1 in thousands' place?

402
176
578

do

A Jim read 86 pages in one book and 112 pages in another book. He read how many pages in all? 3
86 + 112 = ■

B There were 147 pencils in the room. Carol brought 300 more pencils. Then there were how many pencils?
147 + 300 = ■

C 45 + 365 + 421 = ■
D 716 + 84 = ■
E 83 + 79 + 90 = ■
F 155 + 432 = ■
G 68 + 53 + 149 = ■
H 624 + 307 = ■
I 446 + 82 = ■
J 320 + 149 = ■
K 72 + 609 + 125 = ■
L 614 + 189 = ■
M 207 + 198 + 336 = ■
N 53 + 546 = ■
O 825 + 207 = ■
P 94 + 55 + 70 = ■
A 118 + 221 + 539 = ■
B 625 + 275 = ■
C 225 + 707 = ■
D 400 + 264 = ■
E 415 + 683 + 261 = ■
F 768 + 910 + 351 = ■
G 849 + 817 + 538 = ■

Now you should be able to add any numbers with three figures in them.

27

27

1 Have the pupils work this problem on paper without looking at the work in green. Then direct them to compare their work with that shown in the book. If mistakes have been made, the children can find where they occurred.

2 Let the pupils work Examples C, D, and E without looking at the work in green. Then have them compare their work with that in the book and correct any mistakes they have made by doing the work over again.

3 Let the class work these two problems and C to P independently. When most of the class are through, discuss the work and help those who need it. Examples A through G (white on black) are supplied for those who need additional practice.

28-29 Using arithmetic

Expanded Notes for this lesson are on pages 249-251.

Objectives

The child gets practice in analyzing problems. He learns to visualize an additive problem situation expressed in words, to put it in equation form, and to solve it.

Vocabulary

New words page 28 fish*, tanks, beach*, collection; page 29 postcards, goldfish*, graders, drank*

Comments

So far in this book children have met only additive problem situations (in connection with reviewing the addition basic facts and addition of two-figure and three-figure numbers). In these cases, the equations and the computational forms necessary to obtain a solution have been provided.

In this lesson children learn how to think about the conventional verbal problem preparatory to solving it. They learn to describe a problem situation by writing an equation with symbols (such as 2+3=▤) that stands for the situation as they see it (in pictures or visualized from the printed description). Primarily they must learn to note the action taking place in the problem situation. They should be taught not to answer immediately after reading the question, but first to make the equation with the screen (a square will do) in its proper place. This will help them build good habits of problem solving, which are necessary when larger numbers are involved. The habit of making the equation should be formed now.

The problems on pages 28 and 29 are all additive situations. Through discussion and work with them, children should recall or become aware that all situations that involve one group joining or being combined with another group can be expressed with the plus sign.

In some of the problems on page 28 the combining actions actually take place (Problems A, E, F, and H). In other problems, children must learn to imagine that the groups are to be combined (Problems B, C, D, and G).

Problems that are described in words should be thought of as descriptions of real problems. The child should learn to "see" what the words tell him. Pictures A and B show how to visualize Problems A and B. Great care must be taken to avoid any tendency on the part of the child to rely on certain words as clues to the solution of problems. Such words as *more*, *left*, and *together* will turn out to be false clues in other types of problems. The child should make an equation that tells what happened in the situation and then compute with the numbers in the equation to get the answer.

The first four problems on page 28 have the equations given. The screen indicates that a number is missing and must be found. For the next four problems the form of the equation (without numbers) is shown. Children must decide which group is really joined to the other group and what their sum is. Or, in the case of imagined action, they may think of either group joining the other group, since the action may be imagined as happening in either of two ways. That is why two equations are supplied in the answer key for such problems. For the problems on page 29 children must make the equations before finding the answers.

Where basic facts are involved, as in Problems A to C on page 28, the answer is immediately obtained through memory. This answer may be put in place of the screen in a second reading or writing of the equation. In equations involving addition of two-figure and three-figure numbers, figures must be written in computational form and the answer found by addition. The answer then is used in a second writing of the equation.

Answers

The brackets represent the screen in the equation. The number within the brackets is the answer for the problem. Two equations are given for the problems involving action that must be imagined. Either equation should be accepted. Do not require both from the child.

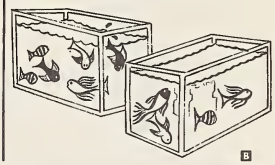
Pages 28-29:

A $3+2=[5]$
B $4+6=[10]$ or $6+4=[10]$
C $7+6=[13]$ or $6+7=[13]$
D $15+17=[32]$ or $17+15=[32]$
E $19+12=[31]$
F $48+17=[65]$
G $8+9=[17]$ or $9+8=[17]$
H $7+3=[10]$
I $11+3=[14]$
J $8+16=[24]$ or $16+8=[24]$
K $13+8=[21]$ or $8+13=[21]$
L $64+96=[160]$ or $96+64=[160]$
M $19¢+15¢=[34¢]$ or $15¢+19¢=[34¢]$
N $200+150=[350]$ or $150+200=[350]$
O $24+26=[50]$ or $26+24=[50]$
P $26+28=[54]$
Q $12+7=[19]$ or $7+12=[19]$
R $15¢+7¢=[22¢]$ or $7¢+15¢=[22¢]$
S $6+12=[18]$ or $12+6=[18]$
T $12+18=[30]$ or $18+12=[30]$

Using arithmetic

2

A



B

A Bill had three bird books. His mother gave him two more bird books. How many bird books did he have then? 1
3 + 2 = ■ 3

B The class had 2 fish tanks. There were 4 fish in one tank and 6 fish in the other tank. There were how many fish in both tanks? 4
4 + 6 = ■

C One tank had 7 gallons of water in it. The other tank had 6 gallons of water. Together, the tanks had how many gallons of water in them? 4
7 + 6 = ■

D Tom brought 15 pictures of birds and 17 pictures of plants to school. He brought how many pictures in all?
15 + 17 = ■ 5

E One weekend Bill found 19 shells on the beach. The next weekend he found 12 shells. How many shells did he find on the two weekends? 6
■ + ■ = ■

F Don had a collection of 48 stones. He found 17 more stones. How many stones did he have then?
■ + ■ = ■

G Carol gave 8 shells to Mary and 9 shells to Betty. How many shells did Carol give to the two girls?
■ + ■ = ■

H The class had 7 plants. Mary's mother gave them 3 more plants. How many plants did the class have then?
■ + ■ = ■

I The class had 11 butterflies. Betty brought 3 more butterflies to class. How many butterflies did the class have then? 1

J The class had 8 books about trees and 16 books about flowers. This was how many books in all? 2 3

K Ann had 13 postcards with pictures of butterflies and 8 postcards with pictures of birds. Ann had how many postcards in all? 3

L Dick read two books about fish. One book had 64 pages. The other book had 96 pages. There were how many pages in the two books? 3

M Don bought 2 goldfish. He paid 19¢ for one fish and 15¢ for the other. He paid how many cents for these fish? 3

N Peggy brought 2 packages of paper from the school storeroom. There were 200 pieces of paper in one package and 150 pieces in the other package. There were how many pieces in all? 3

O The fourth graders drank 24 bottles of milk on Monday. They drank 26 bottles of milk on Tuesday. They drank how many bottles of milk in all on these two days? 3

P Mary had 26 pine cones. She found 28 more pine cones. How many pine cones did she have then?

Q Mary painted some of the cones. She painted 12 of them red and 7 of them yellow. How many pine cones did she paint? 3

R Betty bought 2 boxes of crayons. She paid 15¢ for one box and 7¢ for the other box. She paid how many cents in all for the crayons? 3

S There were 6 crayons in one box and 12 crayons in the other box. There were how many crayons in all? 3

T Carol bought 12 inches of red ribbon and 18 inches of blue ribbon. How many inches of ribbon in all did she buy? 3

Checking up

A	2 + 1 + 5 = ■	G	43 + 39 = ■	M	629 + 295 = ■
B	3 + 6 + 4 = ■	H	61 + 35 = ■	N	178 + 426 = ■
C	4 + 2 + 3 + 6 = ■	I	56 + 80 + 73 = ■	O	513 + 372 = ■
D	7 + 5 + 8 = ■	J	45 + 23 + 62 = ■	P	261 + 105 + 424 = ■
E	8 + 9 + 5 + 7 = ■	K	52 + 9 + 38 = ■	Q	389 + 57 + 536 = ■
F	7 + 3 + 4 + 5 = ■	L	75 + 98 + 86 = ■	R	408 + 579 + 344 = ■

28

1 Have the problem read, but not the equation.
2 Ask the class to look at the picture. Have a pupil tell how many books are on the table. Help children see that the picture shows what the problem describes. Emphasize the action and have them describe the completed group.
3 Draw attention to the equation and have pupils tell what the 3, +, 2, and ■ stand for, using both the problem and the picture. (The plus sign indicates the joining of two groups.)
4 Follow a similar procedure for Problems B and C, using Picture B. Help pupils realize that no real action is taking place. They should imagine that for Problem B the fish are combined, and for Problem C, the water from the two tanks was poured into another larger tank.
5 Have pupils visualize the situation and imagine the action that takes place and the result.
6 Have pupils read Problems E to H, telling the numbers to put in the equations. Then have them write the equations and answers.

29

1 Have one pupil read Problem I. Ask another pupil to make an equation for the problem. Then have the class find the answer.
2 Direct the children to work "on their own" with Problems J to T. Each child is first to make an equation for each problem, using a screen (or square) for the unknown number. Then he is to compute, where necessary, and rewrite the equation with the answer (or write the answer in the square in the original equation). When the class is through, discuss with the children those problems with which they had difficulties.
3 Note that most of these problems involve imagined action and that, in these cases, either form of the equation (see answers) is correct.

29 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his skill in addition involving one-figure, two-figure, and three-figure numbers.

Vocabulary

There are no new words.

Comments

Let the children have plenty of time when they take this end-of-block test in addition. Tell them to copy the labeling letter for each exercise and write the numbers in computational form. Accuracy in transcribing numbers from the book is a part of the test. Each child should do his own transcribing.

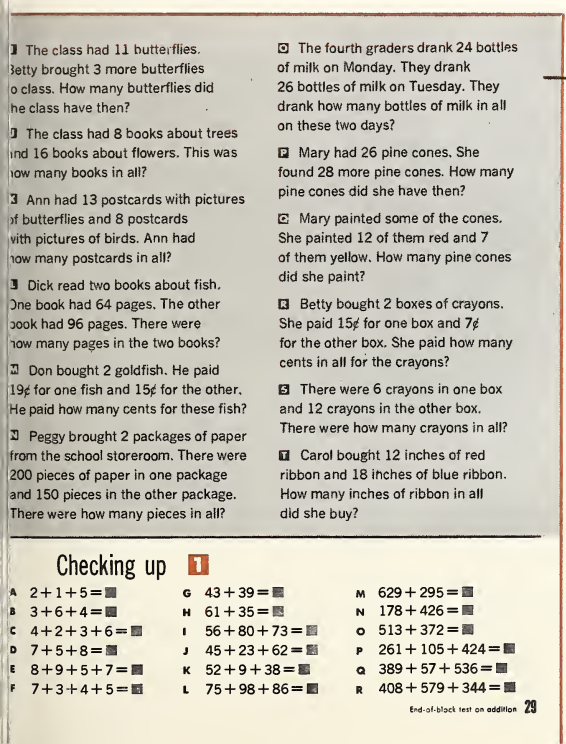
You will note that Examples A to F involve one-figure numbers only, Examples G to L involve two-figure numbers, and Examples M to R involve three-figure numbers. This arrangement will enable you to locate, for each child who has difficulties, the kind of examples that trouble him.

When specific areas of difficulty have been located for individual children, take time to reteach before proceeding further. The lessons preceding this one, on pages 18-27, may be used in working with groups of children who seem to have the same difficulties.

Answers

Page 29:

A 8	E 29	I 209	M 924	Q 982
B 13	F 19	J 130	N 604	R 1331
C 15	G 82	K 99	O 885	
D 20	H 96	L 259	P 790	



J The class had 11 butterflies. Betty brought 3 more butterflies to class. How many butterflies did the class have then?

J The class had 8 books about trees and 16 books about flowers. This was how many books in all?

J Ann had 13 postcards with pictures of butterflies and 8 postcards with pictures of birds. Ann had how many postcards in all?

J Dick read two books about fish. One book had 64 pages. The other book had 96 pages. There were how many pages in the two books?

J Don bought 2 goldfish. He paid 19¢ for one fish and 15¢ for the other. He paid how many cents for these fish?

J Peggy brought 2 packages of paper from the school storeroom. There were 200 pieces of paper in one package and 150 pieces in the other package. There were how many pieces in all?

O The fourth graders drank 24 bottles of milk on Monday. They drank 26 bottles of milk on Tuesday. They drank how many bottles of milk in all on these two days?

P Mary had 26 pine cones. She found 28 more pine cones. How many pine cones did she have then?

C Mary painted some of the cones. She painted 12 of them red and 7 of them yellow. How many pine cones did she paint?

K Betty bought 2 boxes of crayons. She paid 15¢ for one box and 7¢ for the other box. She paid how many cents in all for the crayons?

S There were 6 crayons in one box and 12 crayons in the other box. There were how many crayons in all?

T Carol bought 12 inches of red ribbon and 18 inches of blue ribbon. How many inches of ribbon in all did she buy?

Checking up 1

A 2+1+5=■	G 43+39=■	M 629+295=■
B 3+6+4=■	H 61+35=■	N 178+426=■
C 4+2+3+6=■	I 56+80+73=■	O 513+372=■
D 7+5+8=■	J 45+23+62=■	P 261+105+424=■
E 8+9+5+7=■	K 52+9+38=■	Q 389+57+536=■
F 7+3+4+5=■	L 75+98+86=■	R 408+579+344=■

End-of-block test on addition 29

29

1 Children are to copy each example in computational form. Be sure to tell them to put its identifying letter above it. Give sufficient time for the pupils to finish the test.

30 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child reviews measurement, the number system, and addition of two-figure and three-figure numbers.

Vocabulary

There are no new words.

Comments

The exercises on this page give you an excellent opportunity to diagnose the children's understanding of the topics taught and reviewed so far in this book. The practice material is arranged in four blocks. The first block is concerned with the thermometer. The second block tests the child's knowledge of measures. The third block includes the regrouping of numbers that will be needed for borrowing in subtraction, which follows on page 32. The fourth block provides practice on the addition process, which has just been reviewed. If the children show any weakness in performing on the third block of work, page 14 may be used for practice.

Answers

(block 1)

A 220°
B 8° below 0
C 78°
D Thermometer A
E Thermometer B

(block 2)

A more than
B 2 yards
C 1 gallon
D more than
E a pound
F a yard
G more than
H less than

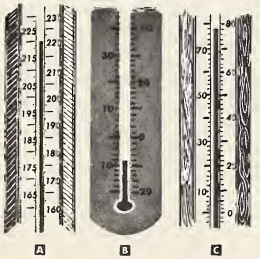
(block 3)

A 12 ones
B 6 tens
C 10 ones
D 1 ten
E 13 tens
F 18 ones

(block 4)

A 141	E 168	I 796	M 1382
B 100	F 932	J 710	N 1272
C 65	G 800	K 1338	O 1308
D 97	H 1158	L 639	

Keeping skillful



1

A About what temperature is shown on Thermometer A?
B About what temperature is shown on Thermometer B?
C About what temperature is shown on Thermometer C?
D Which thermometer shows a temperature that is above the boiling point of water?
E Which thermometer shows a temperature that is below the freezing point of water?

2

A Are 7 inches plus 8 inches more than or less than 1 foot?
B Which is longer, a ribbon 2 yards long or a ribbon 5 feet long?
C Which is less, 5 quarts of milk or 1 gallon of milk?
D Are 2 pints plus 1 pint more than or less than 1 quart?
E Which weighs more, a pound of candy or 10 ounces of candy?
F Which is less, a yard of ribbon or 39 inches of ribbon?
G Are 12 ounces plus 8 ounces more than or less than 1 pound?
H Are 15 inches plus 15 inches more than or less than 1 yard?

3

A 52 can be 4 tens ■ ones.
B 70 can be ■ tens 10 ones.
C 90 can be 8 tens ■ ones.
D 27 can be ■ ten 17 ones.
E 238 can be 1 hundred ■ tens 8 ones.
F 238 can be 2 hundreds 2 tens ■ ones.

4

A 73 + 68 = ■
B 45 + 55 = ■
C 58 + 7 = ■
D 36 + 19 + 42 = ■
E 27 + 50 + 91 = ■
F 403 + 529 = ■
G 768 + 32 = ■
H 225 + 695 + 238 = ■
I 301 + 495 = ■
J 536 + 84 + 90 = ■
K 204 + 458 + 676 = ■
L 86 + 432 + 121 = ■
M 890 + 492 = ■
N 571 + 294 + 407 = ■
O 825 + 483 = ■

5

30

30

1 Call on pupils to answer Questions A to E.
2 Let pupils in turn read and answer Questions A to H.
3 Have children in turn read Exercises A to F saying the missing numbers.
4 Direct the pupils to write Exercises A to O in computational form and to add. Be sure they label each example with its identifying letter.
5 The entire page can be assigned as a written lesson.

31 Checking up

Exponded Notes for this lesson ore on page 251.

Objectives

The child tests his knowledge of the subtraction basic facts.

Vocabulary

New words page 31 subtraction

Comments

This lesson reteaches subtraction basic facts. Pictures A and B help show the subtractive action stated in Problems A and B. The child learns how to write a subtractive problem in equation form. Tests 1 and 2 are inventory tests on subtraction basic facts.

This lesson accomplishes for subtraction and subtraction basic facts what the lesson on page 17 does for addition. It provides inventory tests on the subtraction basic facts. Test 1 is on the basic facts with minuends of 10 or less. Test 2 is on the facts with minuends larger than 10. The purpose of these tests is to reveal any general weakness in the children's knowledge of the subtraction basic facts. Failure to respond correctly on *all* of the items in each test is an indication that reteaching must be done. Encourage each child to keep a list of basic facts that cause him trouble. As he learns he should remove from his list facts that cease to trouble him. Try to get the child to accept the responsibility of learning those facts that he does not know.

Picture A shows real action, in which two boys leave the group. Picture B shows imagined action. Children must be taught to disregard the dimmed group of 7 girls and look at the other four.

Checking up

The work on this page will help you check up on subtraction.

A Seven boys have been playing ball. Two boys have to go home now. How many boys will be left to play ball? 1
7 − 2 = ■

B Eleven girls are having a picnic. Seven girls brought the sandwiches, and the others brought apples. How many girls brought apples? 2
11 − 7 = ■

Test 1

A	10 − 8 = ■	L	9 − 3 = ■
B	6 − 1 = ■	M	5 − 4 = ■
C	8 − 4 = ■	N	10 − 7 = ■
D	7 − 5 = ■	O	6 − 4 = ■
E	4 − 3 = ■	P	9 − 5 = ■
F	9 − 4 = ■ 3	Q	3 − 2 = ■
G	5 − 2 = ■	R	8 − 3 = ■
H	10 − 5 = ■	S	7 − 6 = ■
I	3 − 1 = ■	T	10 − 4 = ■
J	6 − 3 = ■	U	9 − 7 = ■
K	8 − 2 = ■	V	9 − 1 = ■

Test 2

A	13 − 4 = ■	L	16 − 7 = ■
B	17 − 9 = ■	M	15 − 8 = ■
C	12 − 7 = ■	N	11 − 8 = ■
D	14 − 8 = ■	O	12 − 8 = ■
E	11 − 2 = ■	P	12 − 6 = ■
F	15 − 7 = ■ 3	Q	17 − 8 = ■
G	18 − 9 = ■	R	13 − 7 = ■
H	16 − 8 = ■	S	12 − 9 = ■
I	12 − 3 = ■	T	11 − 4 = ■
J	14 − 7 = ■	U	14 − 5 = ■
K	13 − 5 = ■	V	15 − 9 = ■

Inventory tests on subtraction basic facts 31

31

1 Ask a pupil to read Problem A, omitting the equation. Let him explain how Picture A shows the action described in the problem. Let him tell how many boys are in the picture, how many are leaving, and how many are left playing ball. Ask another pupil to state this situation as an equation. Let him read the equation in Problem A, saying the answer.

2 Follow a similar procedure for Problem B. In this case, however, children must imagine that part of the group of 11 girls—the 7 girls who brought sandwiches—are not there. Then they can see that the remaining girls will be the number who brought apples. Be sure they understand that the group imagined as gone is dimmed in the picture.

3 Direct the children to copy the letters A to V and to write the answer to each basic fact opposite its identifying letter. When they are through, read the answers to them and have them mark each error.

32-35 Learning how

Expanded Notes for this lesson are on pages 252-253.

Objectives

The child reviews the subtraction of two-figure numbers with borrowing.

Vocabulary

New words: page 34 single*; page 35 science, kept*, drew*, sheets, began*

Comments

A problem that requires borrowing introduces this lesson on the subtraction of two-figure numbers (42—27). Children know, as a result of previous teaching, that they subtract the ones first. When they find that they cannot subtract 7 from 2, they should remember what they learned in an earlier lesson on regrouping (page 14): that a group of 10 can be changed into 10 ones, which are put with the original ones. Thus they know that 42 can be changed to 3 tens and 12 ones. Then they can subtract 7 from 12 easily, since this merely involves recalling a basic fact they already know. They learn to write the resulting number of ones in ones' place and to subtract the tens and write the result in tens' place.

Not until they have studied and tried several problems and examples involving borrowing do they meet an example that does not require borrowing. Borrowing is taught at the beginning because without it the child gets only a partial idea of the subtraction process. The word *borrowing* is not used in the text, but you may decide to use it. The term is not needed, and many teachers object to its use.

The four-step teaching method is used in this lesson. The first step, SEE, explains with the aid of pictures what the child is expected to do when subtracting two-figure numbers. This step helps the child visualize what is taking place in the regrouping of objects when it is necessary to "borrow" in the computation. The THINK step provides pictures and examples for the child to think through for himself with the help of directions and questions. On page 35, the TRY step supplies the child with problems and examples with answers for comparison with his own work. The DO step offers practice material with no further guidance. The part of each picture under discussion is shown normally; the other part is dimmed off. In the accompanying example, the figures under discussion are in black type and the others are in green, to correspond to the undimmed and dimmed parts of the picture.

Use your own judgment about having children cross out numerals and write the new numerals above the work to show regrouping (for borrowing). It is usually wise to permit children to do this as long as they need to. The first objective is to enable them to subtract. The procedures can be refined later.

Answers

Page 35:

(block 1)

A 36	F 44	K 8	P 83
B 34	G 23	L 44	Q 13
C 24	H 45	M 35	R 41
D 23	I 30	N 75	S 42
E 8	J 66	O 35	T 18

(block 2)

A 50	G 49	L 20
B 17	H 19	M 44
C 8	I 52	N 23
D 35	J 29	O 9
E 7	K 28	P 40
F 7		

Learning how

This lesson will help you remember how to subtract numbers of two figures.

see

A

Bill found 42 shells. He is giving 27 of them to Tom. How many shells will he have left? 1

$42-27=\square$ ← You must find this number.

B

Before you can take away 7 shells, you must empty one box of 10. 2

Before you can subtract 7 ones, you must have more ones. Take one of the tens and put it with the 2 ones. 3

$$\begin{array}{r} 42 \\ 27 \\ \hline \end{array}$$

C

Now you have 3 boxes of 10 shells and also 12 shells. 4

$$\begin{array}{r} {\scriptstyle 3\ 12} \\ 4\not{2} \\ 27 \\ \hline \end{array}$$

Now you have 3 tens and 12 ones. 5

D

Take away 7 shells. 6

$$\begin{array}{r} {\scriptstyle 3\ 12} \\ 4\not{2} \\ 27 \\ \hline 5 \end{array}$$

Subtract 7 ones from 12 ones. There are 5 ones left.

To show that there will be 5 ones in the answer, write 5 here. 7

Reteaching of subtraction of 2-figure numbers with borrowing

E

Next take away 2 boxes of 10 shells.

$$\begin{array}{r} {\scriptstyle 3\ 12} \\ 4\not{2} \\ 27 \\ \hline 15 \end{array}$$

Subtract 2 tens from 3 tens. 1 ten is left. 2

Write 1 here to show 1 ten in the answer.

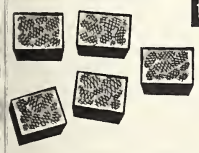
F

Bill will have 15 shells left. 3

$42-27=15$

think

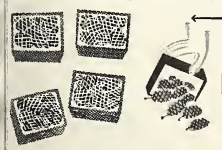
A



Carol and Mary together have 50 pine cones. 29 of them are Carol's. How many of the cones are Mary's? 4

$50-29=\square$ ← You must find this number.

B



Why must you empty 1 box of 10 cones before you can take away 9 cones? 5

$$\begin{array}{r} 50 \\ 29 \\ \hline \end{array}$$

What must you do before you can subtract 9 ones?

Now turn the page.

32

1. Ask the class to read the problem. Ask them to "see" the 42 shells in Picture A. Let a child tell how many shells are in each box and read the equation and statement.
2. Be sure the children understand that a box of 10 must be emptied before 7 shells can be given to Tom.
3. Direct attention to the black numerals in the computation and discuss the need for more ones and where to get them.
4. Be sure the children see that the 4 boxes of 10 shells and 2 single shells are regrouped into 3 boxes of 10 shells and 12 single shells.
5. Help the children relate the black numerals to the rearranged objects in the picture. Explain why the 4 and 2 are crossed out.
6. Discuss what is happening.
7. Get the children to see that the black numerals stand for what is happening in the picture. Be sure they understand that the 7 shells taken away are part of the group of 12.

33

1. Now discuss the action of giving Tom 2 boxes of 10 shells or 2 tens.
2. Be sure the children relate the black numerals to the picture and understand that subtracting 2 tens corresponds to the removing of 2 boxes of 10 shells.
3. Let pupils read the statement in F. Ask them to note the completed equation and to compare the answer with the picture.
4. Let a child read Problem A in the THINK step. Ask how many pine cones each box in the picture contains. Relate the equation to the problem.
5. Point out that in the THINK step the class must think through what they must do in each stage of subtraction. Ask a child to explain what is happening in the picture and why this is necessary. Ask another child to explain why the 0 and 9 are printed in black and for what each stands. Discuss the need for ones and how to get them.

C How many boxes of 10 cones are there? How many single cones are there?

4 10 ← Now you have ■ tens and ■ ones. 2

50
29

D How many of the 10 cones should you take away? How many are left?

← Subtract 9 ones from ■ ones.

4 10
50
29 4

1 ← What does this 1 show?

E How many boxes of 10 cones should you take away?

← Now subtract ■ tens from ■ tens. 6

4 10
50
29
21

What does this 2 show?

F Mary has ■ pine cones. 7

50 − 29 = 21

try

A Bob found 24 stones. He took 18 of them to science class and kept the others at home. How many stones did he keep at home? 1

24 − 18 = ■

1 14 ← Either remember these figures or write them. 2

24
18
6

B 39 − 17 = ■
39
17
22

C 82 − 36 = ■
82
36
46

D 60 − 42 = ■
60
42
18

E 55 − 25 = ■
55
25
30

3

do

A The children drew 71 pictures of the plants and animals they saw in the woods. They put 35 of the pictures in a book. How many pictures were left over? 4

71 − 35 = ■

B Ann found 54 nuts in the woods. She took 20 nuts to school and kept the others. How many did Ann keep?

54 − 20 = ■

C The science class had 40 pine cones. Sixteen cones were large, and the rest were small. How many small cones did the class have?

40 − 16 = ■

D There were 98 sheets of drawing paper when the children began to draw. The children used 75 sheets. How many sheets were left?

98 − 75 = ■

E 75 − 67 = ■
F 96 − 52 = ■
G 41 − 18 = ■
H 65 − 20 = ■
I 73 − 43 = ■
J 90 − 24 = ■
K 27 − 19 = ■
L 87 − 43 = ■

M 67 − 32 = ■
N 84 − 9 = ■
O 70 − 35 = ■
P 91 − 8 = ■
Q 50 − 37 = ■
R 66 − 25 = ■
S 73 − 31 = ■
T 52 − 34 = ■

A 87 − 37 = ■
B 46 − 29 = ■
C 63 − 55 = ■
D 86 − 51 = ■
E 44 − 37 = ■
F 71 − 64 = ■
G 98 − 49 = ■
H 37 − 18 = ■

I 80 − 28 = ■
J 69 − 40 = ■
K 74 − 46 = ■
L 35 − 15 = ■
M 90 − 46 = ■
N 42 − 19 = ■
O 80 − 71 = ■
P 68 − 28 = ■

Now you can subtract numbers of two figures.

34

1 Examine with the children the rearrangeme of the pine cones and the reason for it.

2 Ask the children to explain how the chang in the arrangement of the cones are shown b the black numerals in the computation.

3 Be sure the children understand that 9 Carol's pine cones are being removed.

4 Get pupils to see that we are now doing wi the numbers what is shown in the pictur Be sure they relate the 1 in the answer the 1 cone left.

5 Children should understand that 20 (2 ten of Carol's cones are now being removed.

6 Direct attention to the computation and di cuss what is being done with the black nume als. Relate them to the objects in the pictur relate the subtraction of 2 tens to the remov of the 2 boxes of 10.

7 Have a pupil complete this sentence, note th equation, and refer to the problem.

35

1 Have all pupils read Problem A. Tell them write on their papers the equation for solvin the problem, then check it with the one in th book. Tell them to write the numbers in co putational form and subtract.

2 Tell them to check their work and answer wi this computation.

3 Assign Exercises B to E as tryout work. L pupils work independently and check their ow work with that shown in green. Changes in th minuends may be indicated by the children they wish.

4 Let the pupils know that they can proceed these exercises as soon as they understan how to subtract. The TRY exercises shou alert them to this. Children should write ea example in computational form and label with its identifying letter. Exercises A to (black) should be used by children who nee extra practice.

36-41 Learning how

Expanded Notes for this lesson are on pages 253-254.

Objectives

The child reviews the subtraction of three-figure numbers with borrowing from tens' place and hundreds' place.

Vocabulary

New words page 36 their*, cupboard*; page 38 erasers; page 39 still*; page 41 but*

Comments

This lesson reteaches subtraction of three-figure numbers that involve borrowing twice. Children apply what they have learned about regrouping one hundred into 10 tens, and 1 ten into 10 ones, in situations where they cannot subtract without doing the regrouping.

Again the four-step method is used. The SEE step begins on page 36 and continues to the middle of page 38. The THINK step appears on pages 38 through 40. The TRY and DO steps complete the lesson on page 41.

The dimming-off device is used to indicate the parts of the pictures not of immediate concern. The black figures in the accompanying examples emphasize where the attention is centered in the computation.

Answers

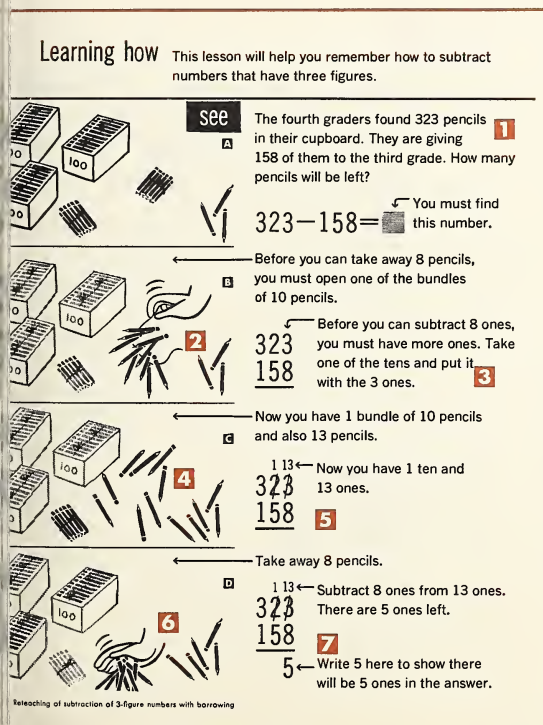
Page 41:

(block 1)

A	544	G	243	M	489	S	355
B	35	H	845	N	89	T	626
C	640	I	404	O	553	U	196
D	170	J	51	P	37	V	156
E	77	K	303	Q	657	W	29
F	171	L	373	R	432	X	409

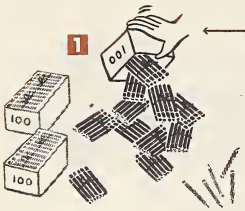
(block 2)

A	457	D	459	G	353	J	461
B	409	E	287	H	107	K	76
C	168	F	408	I	172		


Learning how
This lesson will help you remember how to subtract numbers that have three figures.
see
A
The fourth graders found 323 pencils in their cupboard. They are giving 158 of them to the third grade. How many pencils will be left?
1
323−158=
You must find this number.
B
Before you can take away 8 pencils, you must open one of the bundles of 10 pencils.
2
323
158
Before you can subtract 8 ones, you must have more ones. Take one of the tens and put it with the 3 ones.
3
C
Now you have 1 bundle of 10 pencils and also 13 pencils.
4
1 13
323
158
Now you have 1 ten and 13 ones.
5
D
Take away 8 pencils.
6
1 13
323
158
Subtract 8 ones from 13 ones. There are 5 ones left.
7
5
Write 5 here to show there will be 5 ones in the answer.
Reteaching of subtraction of 3-figure numbers with borrowing

36

1. Have the pupils read the problem. They should understand that the picture shows 323 pencils, which include the 158 that are to be given to the third grade. Let them check the equation with the problem.
2. Be sure the class understands why a bundle of 10 pencils is being opened and put with the 3 single pencils.
3. Direct attention to the black numerals in the computation. Discuss the need for more ones and point out how they are being obtained.
4. Have pupils note in the picture the result of the regrouping of the pencils (3 boxes of 100, 1 bundle of 10, and 13 single pencils).
5. Be sure the pupils relate the black numerals to the ten and ones in the picture.
6. Discuss the action of removing the 8 pencils as the first step of giving 158 away. Note the 5 single pencils remaining.
7. Have the pupils relate each black numeral to the objects in the picture.



E Before you can take away 5 bundles of 10, or 50 pencils, you must empty one of the boxes of 100.

Before you can subtract 5 tens, you must have more tens. Take one of the hundreds and think of it as 10 tens.

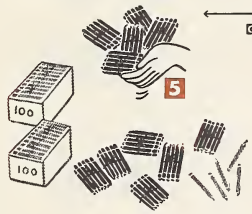
$$\begin{array}{r} {\scriptstyle 1\ 13} \\ 3\not{2}3 \\ 158 \\ \hline 5 \end{array}$$ 2

F Now you have 2 boxes of 100 and you have 11 bundles of 10.

Now you have 2 hundreds and 11 tens.

$$\begin{array}{r} {\scriptstyle 2\ 11\ 13} \\ 3\not{2}\not{3} \\ 158 \\ \hline 5 \end{array}$$ 4

G Take away 5 bundles of 10 pencils.



Subtract 5 tens from 11 tens. There are 6 tens left.

$$\begin{array}{r} {\scriptstyle 2\ 11\ 13} \\ 3\not{2}\not{3} \\ 158 \\ \hline 65 \end{array}$$ 6

Write 6 here to show there are 6 tens in the answer.

Now turn the page.

37

37

1 Direct attention to the picture and get the children to discuss the reasons for emptying a box of 100. Be sure they know that the box contains 10 bundles of 10.

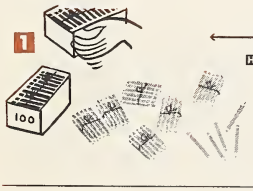
2 Have the pupils observe that to subtract in tens' place (shown in black), more tens are needed. Discuss where to get them.

3 Pupils should note the result of the regrouping of these pencils. Center attention on the hundreds and tens.

4 Relate the black numerals to the picture.

5 Discuss the action of taking away 5 tens, or 50 pencils.

6 Relate the black 11, 5, and 6 to the pencils in the picture.



H Now take away a box of 100 pencils.

Subtract 1 hundred from 2 hundreds. There is 1 hundred left.

$$\begin{array}{r} {\scriptstyle 2\ 11\ 13} \\ 3\not{2}\not{3} \\ 158 \\ \hline 165 \end{array}$$ 2

Write 1 here to show 1 hundred in the answer.

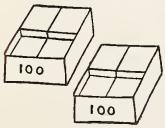
I

165 pencils are left. 3

$323 - 158 = 165$

think

A There were 201 erasers in the school storeroom. The children have bought 64 erasers. How many erasers are left? 4



$201 - 64 = \square$ You must find this number.

5

B Why must you open one of the boxes of 100 erasers before you can take away 4 erasers?

What must you do before you can take away 4 ones?

$$\begin{array}{r} 201 \\ 64 \\ \hline \end{array}$$ 6

38

1 Discuss the action of taking away 100 pencils.

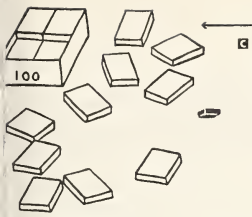
2 Relate the numerals 2, 1, and 1 (in black) to the picture. Be sure the children observe that the subtraction of 1 from 2 corresponds to the action in the picture.

3 Compare the answer in the sentence and equation with the objects in the picture.

4 Be sure the children know they are going to work a new problem. Have them read it and relate it to the picture. Tell them that they must do the thinking now.

5 Discuss the reasons for emptying the box of 100 erasers. The children must think of it as a box of 10 tens, not as 100 individual erasers.

6 Direct attention to the computation and discuss the need for more ones. Let the children discover that they will have to go to hundreds' place to get more ones.



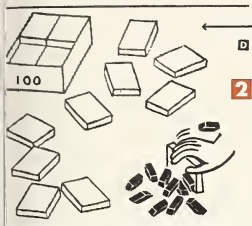
C

Now you have 1 box of 100 erasers and ■ boxes of 10 erasers.

1 10 ← You have ■ hundred and ■ tens.

201
64

1



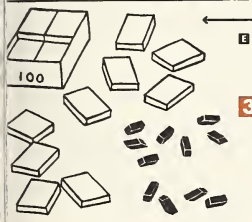
D

Why must you now open another box of erasers, a box of 10?

2

1 10 ← You still need more ones. Where will you get them?

201
64



E

How many boxes of 100 are there now?
How many boxes of 10 are there?
How many single erasers are there?

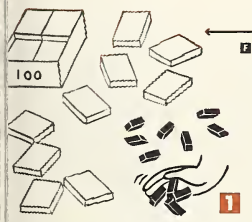
3

9
1 10 11 ← You now have 1 hundred, ■ tens, and ■ ones.

201
64

Now turn the page.

39



F

How many of the 11 erasers should you take away? How many are left?

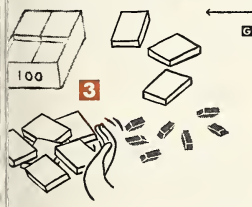
9 ← Subtract 4 ones from ■ ones.

1 10 11
201
64

2

7 ← What does the 7 stand for?

1



G

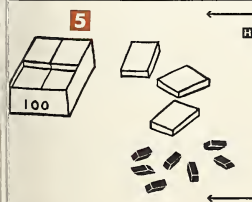
How many boxes of 10 erasers should you take away?

← Now subtract 6 tens from ■ tens.

9
1 10 11
201
64

4

37 ← What does the 3 stand for?



H

Do you need to take away any more erasers? How do you know?

9
1 10 11
201
64

Are there any hundreds to subtract?

137

6

Why do you write this 1?

There are ■ erasers left.

201 − 64 = ■

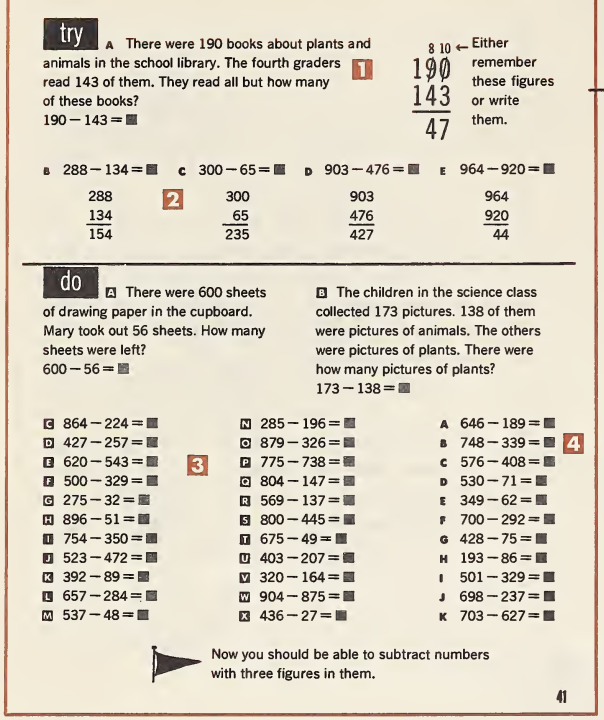
40

39

1. Relate the black numerals in the computation to the regrouping in the picture. Concentrate on the 1 hundred and the 10 tens. The one single eraser is dimmed off.
2. Through discussion get the children to see that there still are not enough single erasers. Let them explain why the box of 10 is being emptied. Be sure to include the black numerals (1 and 4) in the discussion.
3. Now relate the black numerals in the computation to the regrouping shown in the picture. The pupils should understand that no subtracting has been done as yet and that the picture shows the same number of erasers as Picture A. They should also understand that the black numerals (1, 9, 11) represent the same total quantity that 201 does.

40

1. Alert the children to the fact that the 4 single erasers can now be taken away. Discuss what is being done in this picture. Center attention on the single erasers only.
2. Relate the black numerals (11, 4, and 7) to the objects in the picture. Be sure the pupils see that the subtraction of 4 from 11 is shown by the picture.
3. Make clear that 6 boxes of 10 erasers, or 60 erasers, are being taken away.
4. Relate the black numerals (9, 6, and 3) to the objects in the picture.
5. Discuss the reasons for not taking away any hundreds.
6. Make clear the reason for writing 1 in hundreds' place.


try

A There were 190 books about plants and animals in the school library. The fourth graders read 143 of them. They read all but how many of these books?
190 − 143 = ■

1

8 10 ← Either remember these figures or write them.
190
143
47

B 288 − 134 = ■
288
134
154

2

C 300 − 65 = ■
300
65
235

D 903 − 476 = ■
903
476
427

E 964 − 920 = ■
964
920
44

do

A There were 600 sheets of drawing paper in the cupboard. Mary took out 56 sheets. How many sheets were left?
600 − 56 = ■

B The children in the science class collected 173 pictures. 138 of them were pictures of animals. The others were pictures of plants. There were how many pictures of plants?
173 − 138 = ■

3

C 864 − 224 = ■
D 427 − 257 = ■
E 620 − 543 = ■
F 500 − 329 = ■
G 275 − 32 = ■
H 896 − 51 = ■
I 754 − 350 = ■
J 523 − 472 = ■
K 392 − 89 = ■
L 657 − 284 = ■
M 537 − 48 = ■
N 285 − 196 = ■
O 879 − 326 = ■
P 775 − 738 = ■
Q 804 − 147 = ■
R 569 − 137 = ■
S 800 − 445 = ■
T 675 − 49 = ■
U 403 − 207 = ■
V 320 − 164 = ■
W 904 − 875 = ■
X 436 − 27 = ■

4

A 646 − 189 = ■
B 748 − 339 = ■
C 576 − 408 = ■
D 530 − 71 = ■
E 349 − 62 = ■
F 700 − 292 = ■
G 428 − 75 = ■
H 193 − 86 = ■
I 501 − 329 = ■
J 698 − 237 = ■
K 703 − 627 = ■

Now you should be able to subtract numbers with three figures in them.

41

41

1 Direct the pupils to read the problem and its equation. Tell them to write the numerals in a column, to subtract without looking at the green numbers in the book, then to compare their work with that in the book. If necessary, allow the children to continue to write the changed numerals above the example.

2 Ask the pupils to find answers for Examples B to E without looking at the computation shown in the book. When the child checks his answer with the book and sees that it is correct, he may proceed to the DO part of the lesson.

3 Let the pupils use Exercises A to X as written work. They should work independently. Direct them to write the numerals in computational form and to subtract. When they are through, supply answers. Require each child to rework examples in which he has made mistakes.

4 Use Exercises A to K as an assignment for extra practice for those who need it. Follow the procedure described in Note 3.

42-43 Using arithmetic

Expanded Notes for this lesson are on pages 254-256.

Objectives

The child learns to make equations for subtractive situations.

Vocabulary

New words page 42 brother*, frosting*, plain*, raked*, burn*, screens, lost*; page 43 snails

Comments

Before children begin to use their knowledge of subtraction in solving problems, you will want to make sure they know what it is that makes a situation subtractive—that is, when one group is removed from a larger group. So far only the remainder type (finding how many are left) of subtractive situations has been used. All of the problems on pages 42 and 43 are of this type.

In this lesson children learn to describe a subtractive problem situation by writing an equation with symbols (such as 8 − 3 = ■) that stands for the situation as they see it (in pictures or by visualizing from the printed description). Through discussion and work with the problems and pictures on pages 42 and 43, children should become aware that the minus sign is used for all situations that involve one group separating from a larger group, so that a remainder can be seen.

The children should recognize a separating action as a result of understanding the whole situation described, not by reliance on one certain word, such as *fewer* or *left*, in the statement of the problem.

In some cases a picture is given to help them see the separating action taking place (as in Problem A and Picture A), but the children must learn to visualize situations described in words without accompanying pictures. In situations in which no separating action is intended to take place, they must learn to imagine the removal of the described part of the group from the whole group to find a remainder. For example, in Problem B there were 12 cupcakes in all. Frosting was put on 6 of them. The number of cupcakes left un-

frosted is to be found. Picture B illustrates the situation. The cupcakes with frosting on them are of no further concern in solving the problem. So children may imagine them as gone—the group of 6 as separated from the group of 12. This situation can then be expressed in the equation printed below Problem B.

Equations with a screen on the right side of the equals sign are provided for the first four problems. The next three problems provide equations with screens for all three numbers. For the remaining problems, children are to make the equations and solve them.

Answers

Pages 42-43:

A 5	H 85−17=[68]	O 33−15=[18]
B 6	I 36−28=[8]	P 33−14=[19]
C 6	J 20−11=[9]	Q 24−5=[19]
D 12	K 91−63=[28]	R 22−8=[14]
E 10−3=7	L 23−15=[8]	S 31−18=[13]
F 28−6=22	M 30−12=[18]	T 31−6=[25]
G 22−17=5	N 24−16=[8]	U 54−26=[28]

Using arithmetic

There were 8 pieces of candy
n a plate. Carol took 3 pieces and
ft the rest for her brother. How many
eces did she leave for her brother?
−3=■

Carol's mother made 12 cupcakes.
ne put frosting on 6 cupcakes and
ft the rest plain. How many
ıpcakes did Carol's mother leave
ain?
2−6=■

Carol picked 15 flowers
her garden. Nine flowers were
pen. How many flowers were not
pen?
5−9=■

Peggy had 17 pictures of cats. She
ave 5 of them to Carol. Then Peggy
ad how many pictures of cats?
7−5=■

E Carol and Don raked 10 baskets of leaves. They helped their father burn 3 baskets of leaves. They put the rest on the flower beds.
How many baskets of leaves did they put on the flower beds?
■−■=■

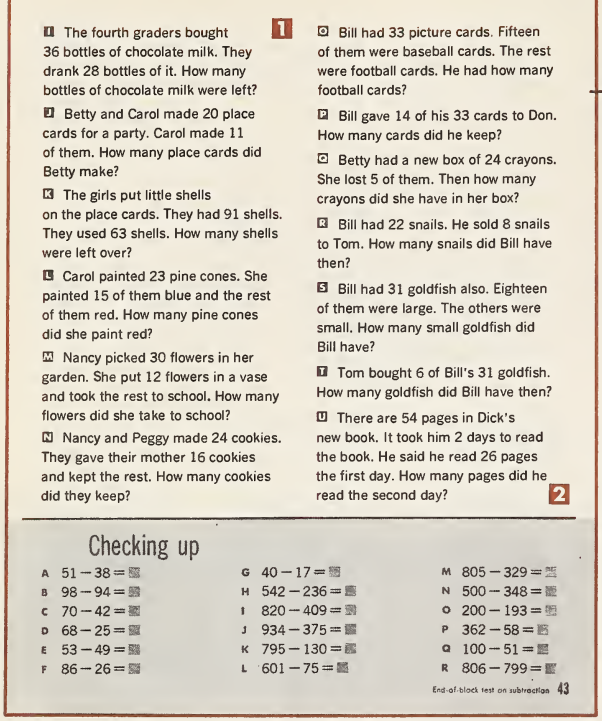
F Don helped his father take down 28 screens. Don took down 6 of them. How many screens were left for his father to take down?
■−■=■

G Don and his father painted 22 screens. His father painted 17 of them. How many did Don paint?
■−■=■

H Don took a bag of 85 marbles to school. He lost 17 marbles in the school yard. Then he had how many marbles?

42

1 Have Problem A read, but not the equation.
2 Ask pupils to point to the 8 pieces of candy. Ask what is being done with 3 of them.
3 Explain that this equation tells what happened in Problem A. Ask what the 8 stands for. Ask how many pieces were taken away. Ask which sign shows that some were taken away. Have the equation read and completed.
4 Proceed in the same way for this problem and Picture B. Ask how many cupcakes are shown. Then have pupils find the 6 frosted cupcakes. Tell them to imagine these are gone, since they are not the ones the problem is asking about. Relate the equation to the picture. Then have the children find the answer.
5 Have Problems C and D read aloud and the equations explained and completed.
6 Let the children try Problems E to G under your supervision. Help them put the numbers in the equations.
7 Help the children make the equation.



I The fourth graders bought 36 bottles of chocolate milk. They drank 28 bottles of it. How many bottles of chocolate milk were left?

J Betty and Carol made 20 place cards for a party. Carol made 11 of them. How many place cards did Betty make?

K The girls put little shells on the place cards. They had 91 shells. They used 63 shells. How many shells were left over?

L Carol painted 23 pine cones. She painted 15 of them blue and the rest of them red. How many pine cones did she paint red?

M Nancy picked 30 flowers in her garden. She put 12 flowers in a vase and took the rest to school. How many flowers did she take to school?

N Nancy and Peggy made 24 cookies. They gave their mother 16 cookies and kept the rest. How many cookies did they keep?

O Bill had 33 picture cards. Fifteen of them were baseball cards. The rest were football cards. He had how many football cards?

P Bill gave 14 of his 33 cards to Don. How many cards did he keep?

Q Betty had a new box of 24 crayons. She lost 5 of them. Then how many crayons did she have in her box?

R Bill had 22 snails. He sold 8 snails to Tom. How many snails did Bill have then?

S Bill had 31 goldfish also. Eighteen of them were large. The others were small. How many small goldfish did Bill have?

T Tom bought 6 of Bill's 31 goldfish. How many goldfish did Bill have then?

U There are 54 pages in Dick's new book. It took him 2 days to read the book. He said he read 26 pages the first day. How many pages did he read the second day?

1

2

Checking up

A 51 − 38 = ▒
B 98 − 94 = ▒
C 70 − 42 = ▒
D 68 − 25 = ▒
E 53 − 49 = ▒
F 86 − 26 = ▒
G 40 − 17 = ▒
H 542 − 236 = ▒
I 820 − 409 = ▒
J 934 − 375 = ▒
K 795 − 130 = ▒
L 601 − 75 = ▒
M 805 − 329 = ▒
N 500 − 348 = ▒
O 200 − 193 = ▒
P 362 − 58 = ▒
Q 100 − 51 = ▒
R 806 − 799 = ▒

End-of-block test on subtraction 43

43 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his ability to subtract two-figure and three-figure numbers.

Vocabulary

There are no new words.

Comments

This end-of-block test should be handled in the same way as the one on page 29. Since this is a power test, children should be given ample time to complete their work. Direct the pupils to copy each example in computational form under its identifying letter.

Answers

Page 43:

A 13	E 4	I 411	M 476	Q 49
B 4	F 60	J 559	N 152	R 7
C 28	G 23	K 665	O 7	
D 43	H 306	L 526	P 304	

43

1 Let the pupils work these problems independently. Direct them first to write an equation with the screen (or square) for the unknown number, then to rewrite it with the answer. If they need to put the numbers in computational form for subtracting, this work should also be shown. Teach the children to label their problems with the identifying letters used in the book. Let the children check their work by comparing it with answers provided by you on the chalkboard or in some other manner.

2 When the pupils have finished, let them take turns reading orally the problems that caused trouble and describing the situations in their own words. Help them make equations for these problems.

I The fourth graders bought 36 bottles of chocolate milk. They drank 28 bottles of it. How many bottles of chocolate milk were left?

J Betty and Carol made 20 place cards for a party. Carol made 11 of them. How many place cards did Betty make?

K The girls put little shells on the place cards. They had 91 shells. They used 63 shells. How many shells were left over?

L Carol painted 23 pine cones. She painted 15 of them blue and the rest of them red. How many pine cones did she paint red?

M Nancy picked 30 flowers in her garden. She put 12 flowers in a vase and took the rest to school. How many flowers did she take to school?

N Nancy and Peggy made 24 cookies. They gave their mother 16 cookies and kept the rest. How many cookies did they keep?

O Bill had 33 picture cards. Fifteen of them were baseball cards. The rest were football cards. He had how many football cards?

P Bill gave 14 of his 33 cards to Don. How many cards did he keep?

Q Betty had a new box of 24 crayons. She lost 5 of them. Then how many crayons did she have in her box?

R Bill had 22 snails. He sold 8 snails to Tom. How many snails did Bill have then?

S Bill had 31 goldfish also. Eighteen of them were large. The others were small. How many small goldfish did Bill have?

T Tom bought 6 of Bill's 31 goldfish. How many goldfish did Bill have then?

U There are 54 pages in Dick's new book. It took him 2 days to read the book. He said he read 26 pages the first day. How many pages did he read the second day?

Checking up

1

A 51 − 38 = ■
B 98 − 94 = ■
C 70 − 42 = ■
D 68 − 25 = ■
E 53 − 49 = ■
F 86 − 26 = ■

2

G 40 − 17 = ■
H 542 − 236 = ■
I 820 − 409 = ■
J 934 − 375 = ■
K 795 − 130 = ■
L 601 − 75 = ■
M 805 − 329 = ■
N 500 − 348 = ■
O 200 − 193 = ■
P 362 − 58 = ■
Q 100 − 51 = ■
R 806 − 799 = ■

End-of-block test on subtraction 43

43

1 Exercises A to G test subtraction of two-figure numbers. If any of the children miss any of these, review with them the work on pages 32 to 35.

2 Exercises H to R test subtraction of three-figure numbers. Use the work on pages 36 to 41 for any necessary review with those children who show further need of it.

44-45 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to distinguish between additive and subtractive situations as described in verbal problems.

Vocabulary

New words page 44 window*, colored*, bean*, seeds*; Page 45 moths

Comments

So far in this book two problem sets under the heading "Using arithmetic" have been provided. The first one consisted of addition problems; the second, subtraction problems. In this third set, children must decide whether the problems call for addition or subtraction.

Help in making the equation is provided for Problems A to H. The numerals have all been put in their proper places in each equation. Only the plus or minus sign must be inserted, and the answer found. For Problems I to N, children must make their own equations.

Answers

Brackets represent the screen in the equation. The numeral within the brackets is the answer. Note that two equations are given for additive problems involving imagined action. Either equation should be accepted.

Pages 44-45:

A 3+2=[5]
B 10−3=[7]
C 10−4=[6]
D 18+9=[27]
or 9+18=[27]
E 20−6=[14]
F 17+4=[21]
G 19+3=[22]
H 7−2=[5]
I 6−2=[4]
J 6+2=[8]
K 14+8=[22]
or 8+14=[22]
L 30−5=[25]
M 13+7=[20]
or 7+13=[20]
N 15−6=[9]

Using arithmetic

A

B

A The science class had 3 turtles. Tom brought 2 more turtles to class. How many turtles did the class have then? **1**
3⟶2 = ■ **2**

B The class had 10 plants on a table. Mary is going to put 3 of the plants in the window. How many plants will be left on the table? **3**
10⟶3 = ■

C Four of the 10 plants had flowers on them. How many of the plants did not have flowers? **4**
10⟶4 = ■

D Don brought 18 colored stones to class. Bill brought 9 stones. The two boys brought how many stones in all?
18⟶9 = ■

E Betty planted 20 bean seeds in a box. Six of the seeds came up. How many of the seeds did not come up?
20⟶6 = ■

F Nancy had 17 shells. Carol gave her 4 more shells. How many shells did Nancy have then?
17⟶4 = ■

G Bob had 19 pictures of birds. Tom gave him 3 more pictures of birds. Then Bob had how many pictures of birds?
19⟶3 = ■

H The class had 7 white mice. Bill bought 2 of them to take home. How many white mice did the class have then? **5**
7⟶2 = ■

I Ann had 6 fish at home. She brought 2 of them to class. Then how many fish did she have at home? **1**

J The class had 6 snails. Bob brought 2 more snails to class. Then how many snails did the class have?

K Tom had 14 pictures of butterflies at home and 8 pictures of butterflies at school. He had how many pictures of butterflies in all?

L Ann picked 30 colored leaves. She gave 5 of them to Nancy. Then she had how many colored leaves?

M The class collected 13 moths and 7 butterflies. The class had how many moths and butterflies in all?

N Carol planted some flower seeds. 6 of the 15 plants that came up had blue flowers. The others had red flowers. How many had red flowers? **2**

Keeping skillful

Subtract numbers that have four figures just as you subtract numbers that have three figures.
3239 − 1538 = ■

Why do you put a 0 in tens' place in the answer?

$$\begin{array}{r} {\scriptstyle 2\ 12} \\ 3\not{2}39 \\ 1538 \\ \hline 1701 \end{array}$$

Before you can subtract 5 hundreds, you have to take 1 of the 3 thousands and put it with the 2 hundreds.

A	3406 − 2098 = ■	A	48 + 22 + 61 = ■	A	53 + 25 + 71 = ■
B	536 − 290 = ■	B	417 + 138 + 502 = ■	B	1932 − 1659 = ■
C	300 − 142 = ■	C	634 + 807 = ■	C	116 + 429 + 270 = ■
D	5208 − 3768 = ■	D	28 + 17 + 58 = ■	D	417 − 328 = ■
E	708 − 625 = ■	E	987 + 638 = ■	E	70 − 49 = ■
F	1826 − 755 = ■	F	634 + 727 = ■	F	987 + 65 + 138 = ■
G	842 − 237 = ■	G	783 + 214 + 695 = ■	G	921 − 518 = ■
H	5934 − 1879 = ■	H	35 + 19 + 40 = ■	H	389 + 156 + 420 = ■
I	962 − 308 = ■	I	268 + 712 + 455 = ■	I	2362 − 1817 = ■

44

1. Ask pupils to read this problem, omitting the equation. Then refer to the picture to see how it shows the problem. Discuss the action.
2. Now have the class look at the equation. Relate the numbers to the problem and picture. Have the children decide which symbol (+ or −) belongs where the wavy line is and state why they chose the symbol they did. Get them to restate the equation with the answer.
3. Use the same procedure with this problem, its picture, and equation.
4. Tell the children that they are to work Problems C to H independently and do the following: Read the problem, write the equation with the proper symbol (+ or −), find the answer, rewrite the equation with the answer.
5. Before going on to page 45, check the work and talk over the problems. If necessary, let a child show with objects what happens in each problem.

45

1. Direct the children to continue to work independently with Problems I to N. Tell them to make their own equations with the correct symbol (+ or −) and a screen (or square) for the number they are to find. Then they should write the equations again with the answers. Be sure they label their equations with the identifying letters.
2. Discuss the problems with the children when the class is through. Let the children take turns writing the equations on the board, both with the screen and with the answer.

45 Keeping skillful

Expanded Notes for this lesson are on page 256.

Objectives

The child extends his knowledge of subtraction to numbers of four figures. He also reviews addition and subtraction of two-place and three-place numbers.

Vocabulary

No new words are introduced.

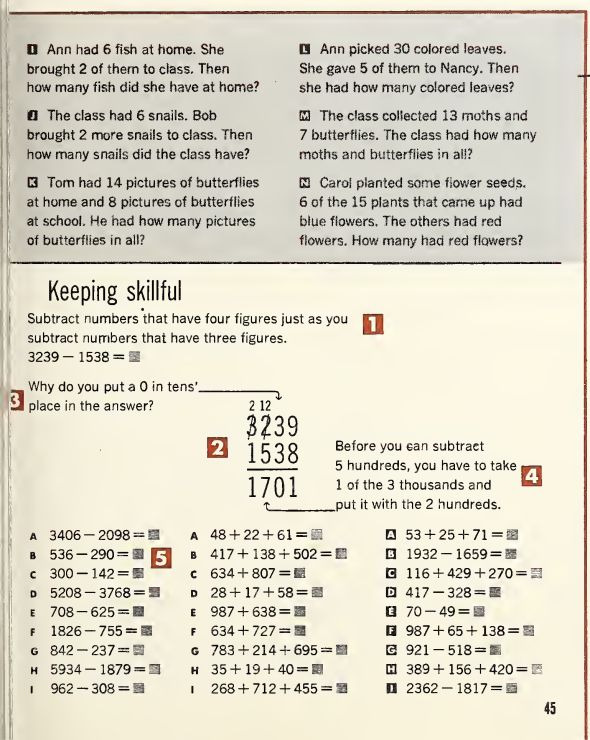
Comments

Pages 36 to 41 provided a review for the child in subtracting three-figure numbers. This lesson shows how to subtract numbers with four places.

Nothing really new is presented here. Theoretically, the child should now be able to subtract whole numbers of any size. He should, by this time, have generalized the borrowing procedure as it operates from column to column. Treat the example at the beginning orally. Devote some time to a discussion of borrowing from tens' place, hundreds' place, and thousands' place. Then assign the remaining exercises as written work.

Answers

(block 1)	(block 2)	(block 3)
A 1308	A 131	A 149
B 246	B 1057	B 273
C 158	C 1441	C 815
D 1440	D 103	D 89
E 83	E 1625	E 21
F 1071	F 1361	F 1190
G 605	G 1692	G 403
H 4055	H 94	H 965
I 654	I 1435	I 545



J Ann had 6 fish at home. She brought 2 of them to class. Then how many fish did she have at home?

K Ann picked 30 colored leaves. She gave 5 of them to Nancy. Then she had how many colored leaves?

L The class had 6 snails. Bob brought 2 more snails to class. Then how many snails did the class have?

M The class collected 13 moths and 7 butterflies. The class had how many moths and butterflies in all?

N Tom had 14 pictures of butterflies at home and 8 pictures of butterflies at school. He had how many pictures of butterflies in all?

O Carol planted some flower seeds. 6 of the 15 plants that came up had blue flowers. The others had red flowers. How many had red flowers?

Keeping skillful

Subtract numbers that have four figures just as you subtract numbers that have three figures. 1

3239 − 1538 = ▩

3 Why do you put a 0 in tens' place in the answer?

2 12
3239
1538
1701

2 Before you can subtract 5 hundreds, you have to take 1 of the 3 thousands and put it with the 2 hundreds. 4

5

A 3406 − 2098 = ▩	A 48 + 22 + 61 = ▩	A 53 + 25 + 71 = ▩
B 536 − 290 = ▩	B 417 + 138 + 502 = ▩	B 1932 − 1659 = ▩
C 300 − 142 = ▩	C 634 + 807 = ▩	C 116 + 429 + 270 = ▩
D 5208 − 3768 = ▩	D 28 + 17 + 58 = ▩	D 417 − 328 = ▩
E 708 − 625 = ▩	E 987 + 638 = ▩	E 70 − 49 = ▩
F 1826 − 755 = ▩	F 634 + 727 = ▩	F 987 + 65 + 138 = ▩
G 842 − 237 = ▩	G 783 + 214 + 695 = ▩	G 921 − 518 = ▩
H 5934 − 1879 = ▩	H 35 + 19 + 40 = ▩	H 389 + 156 + 420 = ▩
I 962 − 308 = ▩	I 268 + 712 + 455 = ▩	I 2362 − 1817 = ▩

45

45

1 Ask pupils to read this statement and the equation, without filling in the screen.

2 Call attention to the computational form. Ask one pupil to explain how to subtract in the ones' column.

3 Discuss this question about 0 in tens' place.

4 Call on another pupil to read this statement pointing to hundreds' place. Have him explain why he cannot subtract 5 hundreds from the original number above it. Ask how many hundreds the borrowed 1 thousand makes. Ask where the 12 in the hundreds' column comes from. Be sure the pupils know they are now subtracting 5 hundreds from 12 hundreds.

5 Tell pupils to work the three sets of examples. Instruct them to copy each example in computational form under its identifying letter. Examples A to E in each set may be assigned for one day and the others for another day if you wish.

46-48 Looking back

Expanded Notes for this lesson are on pages 257-258.

Objectives

The child reviews the meaning of multiplication and the multiplication basic facts for the groups through 18 (basic facts whose products are 18 or less).

Vocabulary

New words page 46 multiplication; page 47 rows*

Comments

In reviewing the multiplication basic facts, you will want to be sure that children understand what makes a situation multiplicative. Otherwise, when they begin to solve problems, they may tend to think of multiplicative situations as additive situations. Emphasize the idea that, in the multiplicative situation, two or more groups of *equal* size are joined together to make one larger group. Be sure children observe not only the equality and size of the groups, but also the number of groups that are being combined. In additive situations one group is thought of as being put with another group, but the two groups are not necessarily equal.

On page 46, the multiplication concept is reviewed with problems and pictures illustrating 4×2 and 3×3. The various ways of expressing basic facts are also shown. Pictures A and B have two scenes each. The first scene shows a number of equal groups. The second scene shows the result of combining the equal groups.

To develop the meaning of multiplication more thoroughly, it might be well to supplement the work on this page with activities with real objects. Let the children duplicate with objects (buttons, stones, corks, etc.) the groups shown in the first scene of Picture A. Be sure they focus attention on the size and number of equal groups. Then tell them to move the groups together so there is one large group and to note the result. Use the same activity with Picture B.

On page 47 all the multiplication basic facts for the 12, 14, and 15 groups are presented pictorially, and one of the basic facts for the 16 group is included. Each picture, except the one illustrating $4\times4=16$, is used to illustrate two multiplication basic facts. This is possible because objects are pictured as arranged in rows that may be viewed either horizontally or vertically. Thus the basic fact $3\times4=12$ is illustrated by three rows of four objects each that are viewed first as separate rows and then as one large group. The basic fact $4\times3=12$ is seen by viewing the same picture as four rows of three objects that combine into one large group of 12. This arrangement in the illustration enables the child to see quickly that either order of the factors (3×4 or 4×3) gives the same answer.

The device of circling or ringing a group of ten objects within a larger group is used to help children determine how many there are in all without counting by ones. By immediately seeing that there are ten, they can quickly see how many ones there are outside the ring. By now they should know that a ten and so many more ones give a "teen" number.

This technique of illustrating objects in rows, with ten objects ringed, is used on page 48 to complete the review of multiplication basic facts for the 16 and 18 groups. Practice is given in equation form. The computational form of multiplication is, of course, unnecessary at this time, since only basic facts are encountered. The computational form is included (first on page 46) so that children will recognize it and know what to do with it if they should meet it elsewhere.

Looking back

This lesson will help you remember what multiplication means and how to multiply to get numbers like 8, 10, 12, 15, and 18.

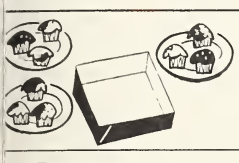
There were 2 popcorn balls on each of 4 plates. Ann put the popcorn balls in a basket to take to a party at school. She took how many popcorn balls to the party? 1

A

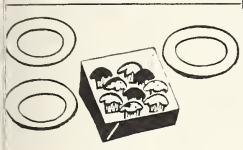
4 groups of 2 = ■
4 twos = ■ 4 times 2 = ■ 4
2 multiplied by 4 = ■
Multiply 2 by 4. 4 × 2 = ■

Multiply

$$\begin{array}{r} 2 \\ \times\ 4 \\ \hline \blacksquare \end{array}$$ 5



There were 3 cupcakes on each of 3 plates. Betty put the cupcakes into a box to take them to the party at school. How many cupcakes did she take to the party? 6

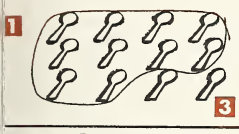


B

3 groups of 3 = ■
3 threes = ■ 3 times 3 = ■
3 multiplied by 3 = ■
Multiply 3 by 3. 3 × 3 = ■

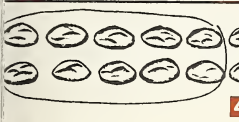
A 5 × 2 = ■
B 2 × 3 = ■
C 3 × 3 = ■
D 4 × 2 = ■
E 3 × 2 = ■
F 2 × 2 = ■ 7
G 2 × 4 = ■
H 2 × 5 = ■

Review of multiplication concepts and vocabulary; basic facts with products of 18 or less



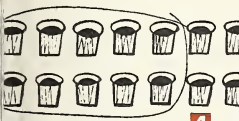
C

There are ■ rows of 4 spoons. 2
3 fours = ■
3 × 4 = ■
There are ■ rows of 3 spoons.
4 threes = ■
4 × 3 = ■



D

There are ■ rows of 6 cookies.
2 sixes = ■
2 × 6 = ■
There are ■ rows of 2 cookies.
6 twos = ■
6 × 2 = ■

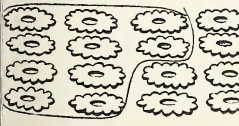


E

There are ■ rows of 7 cups.
2 sevens = ■
2 × 7 = ■
There are ■ rows of 2 cups.
7 twos = ■
7 × 2 = ■

F

There are ■ rows of 5 candies.
3 fives = ■
3 × 5 = ■
There are ■ rows of 3 candies.
5 threes = ■
5 × 3 = ■



G

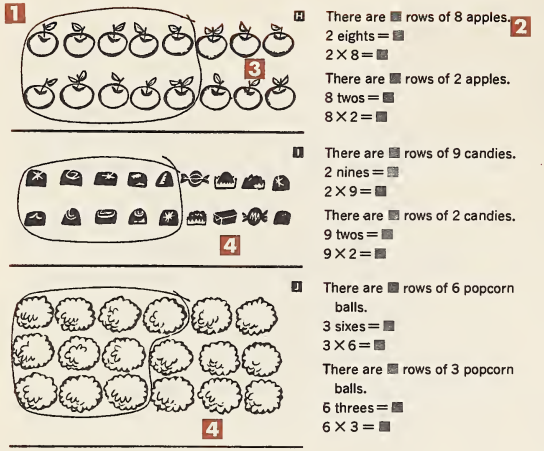
There are ■ rows of 4 cookies.
4 fours = ■
4 × 4 = ■

46

1 Ask pupils to read only the problem.
2 Have them look at this scene of Movie A, pointing to the objects mentioned in the first sentence. Ask them how many groups of two there are.
3 Ask them what has now happened to the 4 groups of two. Ask how many there are in all.
4 Explain that the next four lines are different ways of telling the story of Movie A. Let pupils take turns reading a line aloud and supplying the missing numbers.
5 Tell pupils that this computational form is used to write numbers in multiplication. Have someone read it aloud, first as "4 times 2 equals what," then as "4 times 2 equals 8."
6 Treat this problem, its movie, and the various statements as suggested above. You might ask one of the pupils to write the basic fact for 3 × 3 on the board in computational form.
7 Have pupils take turns reading these equations and supplying the answers.

47

1 Ask pupils how many spoons are in the first row across. Ask if the other rows have the same number in them. Ask how many rows of four there are. Suggest to the children that they may think of the 3 rows of four as 3 groups of four. Next ask them to think of the 3 groups of four as one large group. Remind them that when equal groups combine, they should think of multiplication. Then point out that there is a ring around ten of the spoons. Have someone tell how many spoons are outside the ring. Ask how many 1 ten and 2 ones are.
2 Let pupils take turns reading the first three lines, using the picture to find the answers.
3 Ask pupils how many spoons there are in the first up-and-down row. Let them tell how many rows of three there are. Ask them to think of the 4 groups of 3 as one large group. Ask how many there are in all. Then have them read the last three lines as suggested in Note 2.
4 Proceed in the same way with this picture.


1
H
There are ■ rows of 8 apples.
2 eights = ■
2 × 8 = ■
There are ■ rows of 2 apples.
8 twos = ■
8 × 2 = ■
2
3
I
There are ■ rows of 9 candies.
2 nines = ■
2 × 9 = ■
There are ■ rows of 2 candies.
9 twos = ■
9 × 2 = ■
4
J
There are ■ rows of 6 popcorn balls.
3 sixes = ■
3 × 6 = ■
There are ■ rows of 3 popcorn balls.
6 threes = ■
6 × 3 = ■
4

5

A	4×4=■	F	2×8=■	K	6×3=■				
B	6×2=■	G	7×2=■	L	8×2=■				
C	3×5=■	H	3×6=■	M	4×3=■				
D	9×2=■	I	2×7=■	N	2×6=■				
E	3×4=■	J	2×9=■	O	5×3=■				

6

Multiply

A	B	C	D	E
7	2	6	4	5
2	9	3	4	3
■	■	■	■	■

Now you should be able to multiply to get the numbers from 4 to 18.

49

48

1 Ask pupils how many apples there are in the top row. Ask if there are as many apples in the second row. Ask how many rows or groups of 8 there are. Have someone tell how many there are in all, using the ring around ten to find out.

2 Let pupils read the first three lines, using the picture to find the missing numbers.

3 Ask how many apples there are in each up-and-down row. Find out how many rows of two there are. Ask pupils how many apples there are in all when the groups of two are thought of as one large group. The ring around ten apples will help show the answer. Have them complete the statements at the right.

4 Proceed in the same way with this picture.

5 Have pupils take turns answering these exercises. Then have them write the letters A to O with the answers.

6 Have pupils copy these exercises and supply the answers.

49-51 Looking back

Expanded Notes for this lesson are on pages 259-260.

Objectives

The child reviews all multiplication basic facts whose products are 20, 21, 24, 25, 27, 28, 30, 32, 35, and 36.

Vocabulary

There are no new words.

Comments

The school-party theme is continued from the previous lesson. Multiplication basic facts for the 20 to 36 groups are shown in two ways: in picture form and in the words or symbols of a mathematical statement.

Page 49 begins the review with the facts for the 20 group. These facts are shown in an illustration of 20 cupcakes, arranged in such a way that four equal rows can be seen horizontally and five equal rows can be seen vertically. Two groups of ten have been encircled to help the child see that in this picture there are two tens, or twenty. This circling device for quick recognition of groups of ten is used in each picture throughout this lesson. Since the first facts reviewed are for the 20 group, there are no objects outside the rings. As the lesson continues with products of more than 20, there are some objects outside the rings, as in Picture B on page 49. Here the child should have no difficulty in recognizing the entire group as being made up of two tens (ringed) and a one, or 21.

With the exception of the first picture on page 50, which shows the single multiplication basic fact for the 25 group, and the last picture on page 51, which shows one of the facts for the 36 group, each picture is used to illustrate two facts. The arrangement in these illustrations enables the child to see quickly that either order of the factors (4×5 or 5×4) gives the same answer.

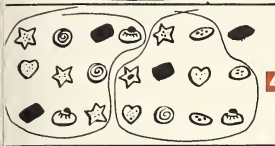
Looking back

This lesson will help you remember how to multiply to get numbers from 20 to 36.

A

There are 4 rows of 5 cupcakes. 2
4 fives = ■
4 × 5 = ■

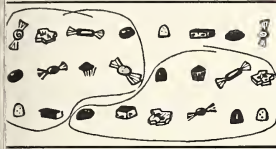
There are 5 rows of 4 cupcakes.
5 fours = ■
5 × 4 = ■



B

There are ■ rows of 7 cookies.
3 sevens = ■
3 × 7 = ■

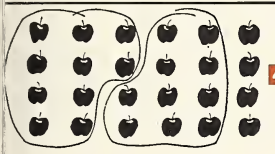
There are ■ rows of 3 cookies.
7 threes = ■
7 × 3 = ■



C

There are ■ rows of 8 candies.
3 eights = ■
3 × 8 = ■

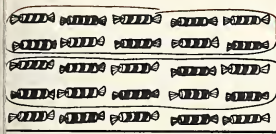
There are ■ rows of 3 candies.
8 threes = ■
8 × 3 = ■



D

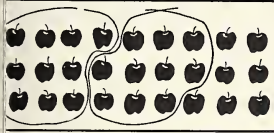
There are ■ rows of 6 apples.
4 sixes = ■
4 × 6 = ■

There are ■ rows of 4 apples.
6 fours = ■
6 × 4 = ■



E

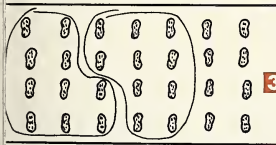
There are ■ rows of 5 candy sticks.
5 fives = ■ 2
5 × 5 = ■



F

There are ■ rows of 9 apples.
3 nines = ■
3 × 9 = ■

There are ■ rows of 3 apples.
9 threes = ■
9 × 3 = ■



G

There are ■ rows of 7 peanuts.
4 sevens = ■
4 × 7 = ■

There are ■ rows of 4 peanuts.
7 fours = ■
7 × 4 = ■

H

There are ■ rows of 6 candies.
5 sixes = ■
5 × 6 = ■

There are ■ rows of 5 candies.
6 fives = ■
6 × 5 = ■

I

There are ■ rows of 8 cupcakes.
4 eights = ■
4 × 8 = ■

There are ■ rows of 4 cupcakes.
8 fours = ■
8 × 4 = ■

49

1 Show the children the first horizontal row of cupcakes. Ask: "How many cupcakes are there in this row? How many rows like this are there? How many *groups* of five cupcakes are there? How many cupcakes are there in all?" Be sure the children understand that each ring encloses 10 cupcakes, and that there are no cupcakes outside the two rings.

2 Have one child read the first line of text aloud. Direct attention to the picture. The statement on the next line may be presented to the children as a question: "Four fives equal how many?" Have them refer again to the picture for the answer. Have another child read the second and third lines aloud, supplying the missing numbers in the equations.

3 Proceed in the same way for the 5 vertical rows of 4 cupcakes and the accompanying text.

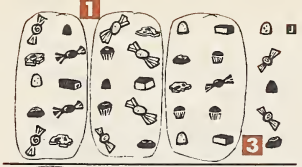
4 Use the method described in Notes 1, 2, and 3. Note that a missing number is to be supplied in each line of text.

50

1 Show the children the first picture and ask: "How many candy sticks are there in the first row? How many equal rows are there? How many groups of candy sticks are there? How many candy sticks are in the two rings? How many are outside the rings? How many candy sticks are there altogether?"

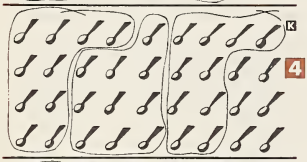
2 Have several children take turns reading one line of the text at a time. As they read, make sure they say the number that has been left out of each line of text. In discussion, have them refer back to the picture.

3 Use the method described in Notes 1 and 2 for both the horizontal and vertical rows, since two facts are presented in the picture and its accompanying text.



There are ▭ rows of 7 candies.
5 sevens = ▭
5 × 7 = ▭

There are ▭ rows of 5 candies.
7 fives = ▭
7 × 5 = ▭



There are ▭ rows of 9 spoons.
4 nines = ▭
4 × 9 = ▭

There are ▭ rows of 4 spoons.
9 fours = ▭
9 × 4 = ▭

There are ▭ rows of 6 cups.
6 sixes = ▭
6 × 6 = ▭

A 8 × 3 = ▭	I 6 × 6 = ▭	Q 7 × 4 = ▭	A 6 × 6 = ▭
B 5 × 4 = ▭	J 4 × 6 = ▭	R 4 × 5 = ▭	B 5 × 7 = ▭
C 3 × 9 = ▭	K 9 × 4 = ▭	S 5 × 7 = ▭	C 9 × 4 = ▭
D 4 × 7 = ▭	L 5 × 5 = ▭	T 7 × 3 = ▭	D 6 × 5 = ▭
E 8 × 4 = ▭	M 3 × 8 = ▭	U 4 × 9 = ▭	E 4 × 6 = ▭
F 5 × 6 = ▭	N 9 × 3 = ▭	V 6 × 4 = ▭	F 5 × 5 = ▭
G 3 × 7 = ▭	O 4 × 8 = ▭		G 8 × 4 = ▭
H 7 × 5 = ▭	P 6 × 5 = ▭		H 4 × 7 = ▭

Now you should know how to multiply to get the numbers from 20 to 36.

51

51

1. Start with the first picture and ask the children how many candies there are in the first row across. Then ask how many rows of 7 candies there are. Make certain the class understands that the rings indicate 3 groups of 10. Draw attention to the candies not ringed. Then ask the class how many candies there are altogether.
2. Refer to the picture again. This time have several children read aloud the accompanying three lines of text. They should say the missing number in each statement or equation as they read.
3. Follow the same procedure for the vertical rows of candies and the accompanying text.
4. For Picture K use Notes 1, 2, and 3.
5. Use the method described in Notes 1 and 2.
6. All the reviewed basic facts are included in Exercises A to V. These exercises may be answered first orally, then as written work.
7. Use the procedure described in Note 6.

52-53 Using arithmetic

Exponded Notes for this lesson ore on page 260.

Objectives

The child learns to make equations to use in solving problems involving multiplicative situations.

Vocabulary

New words page 52 Mrs.*, Sue, race*; page 53 walls*

Comments

In this lesson children use multiplication basic facts to solve problems. They learn to recognize a multiplicative situation described in words, to visualize what happens, and to turn this information into a multiplicative equation.

Four problems on page 52 have the equations all set up except for the answers. Four other problems have the multiplicative equation indicated by screens, the times sign, and the equals sign. Children must decide which number to put in place of the screens in these problems.

To make sure that children understand the multiplicative situation, insist that they make the correct equation. They should be taught to place the numeral that stands for the number of groups at the left of the times sign and the numeral that stands for the size of the groups at the right of the times sign. Discussion of Picture A on page 52 and its equation should help develop these understandings. In abstract computation, of course, this distinction is unnecessary, since the product is the same no matter which order of factors is used.

For the problems on page 53, children must build their own equations and find the solutions. Children are to write each equation first with the screen placed after the equals sign, then with the answer inserted.

Answers

E 3 × 6 = [18]	I 2 × 9 = [18]	M 4 × 6 = [24]
F 3 × 9 = [27]	J 4 × 9 = [36]	N 3 × 4 = [12]
G 7 × 2 = [14]	K 5 × 7 = [35]	O 4 × 7 = [28]
H 5 × 4 = [20]	L 3 × 7 = [21]	P 5 × 6 = [30]

A

B

Four groups of 2 children played ame at a school party. How many ildren in all were in this game? 1
× 2 = ■ 3

Ann opened 4 packages of paper ates for the party. There were plates in each package. There were w many plates in all? 4
× 8 = ■

Ann also opened 6 packages paper cups. There were 6 cups each package. How many cups in all re in the packages? 5
× 6 = ■

Mrs. Brown cut a cake so that ere were 3 rows of pieces and pieces in each row. She cut the cake o how many pieces? 6
× 8 = ■

lving problems by multiplication

E Nancy, Carol, and Sue brought 6 cupcakes each to the party. They brought how many cupcakes in all? 6
■ × ■ = ■

F The class had a race. There were 3 teams of players and 9 players on each team. How many children were in the race? 6
■ × ■ = ■

G Mary said that she made 2 party hats each day last week. How many party hats in all did she make last week? 6
THINK 1 week is how many days?
■ × ■ = ■

H Five children brought apples to the party. Each child brought 4 apples. How many apples in all did these children bring to the party? 6
■ × ■ = ■

I At the school party, there were just nough boys to make 2 teams of 9 ach for baseball. How many boys ere at the party? 1

Four children brought balloons the party. Each child brought balloons. How many balloons in all d the children bring? 2

There were 5 rows of milk bottles n a table. Each row had 7 bottles milk in it. How many bottles of milk ere on the table?

The children drew pictures to put n 3 walls of their classroom. They ew 7 pictures for each wall. In all, ow many pictures did they draw?

M Mary brought cookies and put them on 4 plates. She put 6 cookies on each plate. How many cookies had she brought?

N Jack brought 3 boxes of games. There were 4 games in each box. How many games did he bring?

O After the party, Ann collected empty plates from 4 tables. She got 7 plates from each table. How many plates did she collect altogether?

P Five cars came to take the children home. Jim counted all the children and said, "If each car can take 6 children, we can all ride." How many children did Jim count?

Checking up

	Test 1	Test 2	Test 3	Test 4
A	4×3=■	2×9=■	4×5=■	6×6=■
B	3×2=■	3×5=■	6×4=■	7×4=■
C	2×5=■	6×3=■	7×3=■	5×6=■
D	2×2=■	2×7=■	5×5=■	3×9=■
E	6×2=■	4×4=■	4×6=■	8×4=■
F	3×3=■	7×2=■	5×4=■	4×9=■
G	2×3=■	9×2=■	8×3=■	6×5=■
H	4×2=■	5×3=■	3×7=■	9×4=■
I	3×4=■	8×2=■	9×3=■	5×7=■
J	2×6=■	3×6=■	6×3=■	4×8=■
K	2×4=■	2×8=■	3×9=■	7×5=■
L	5×2=■	3×5=■	3×8=■	4×7=■

End-of-block tests on basic multiplication facts with products up to and including 36 53

52

1 Have this problem read except for the equation.

2 Have pupils discuss Picture A, telling how many children are in each group and how many groups there are. Ask them to think of the 4 groups of 2 children as coming together into one large group. Ask them if this makes them think of addition or multiplication and why. Ask how many children there would be in all.

3 Ask a pupil to read this equation, giving the answer. Ask which number tells how many groups there are and which one tells the size of each group.

4 Proceed in the same way with this problem and its picture.

5 Proceed in the same way with this problem. Let the children describe a picture for it.

6 Proceed in the same way with this problem. Help the children complete the equations.

53

1 Call on a child to read this problem aloud. Have pupils discuss it, determining that this is a multiplication problem. Let them decide which numeral should be at the left of the times sign and which numeral should be at the right of it. Ask someone to write on the board the equation with the numerals and times sign in the correct order and with a screen at the right of the equals sign. Have someone else give the answer.

2 Assign Problems J to P as written work. When all the children have finished, let them take turns writing on the board an equation for one of the problems. Tell each child to be ready to explain why he made his equation as he did. Let the other pupils check their own work against that placed on the board.

53 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child takes tests on all the multiplication basic facts through the 36 group (the multiplication basic facts whose products are 36 or less).

Vocabulary

There are no new words.

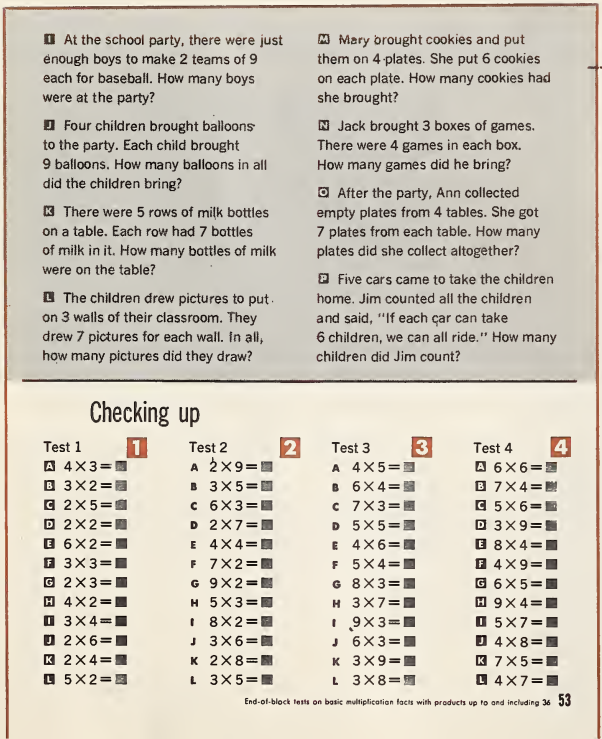
Comments

Since these are not speed tests, you should give the children ample time to complete their work.

You should expect the pupils to know all these basic facts. One of the greatest sources of failure in arithmetic is inadequate recall of basic facts.

Ask pupils to copy the labeling letter for each basic fact and write the answer on their papers. If you prefer, the children may write the entire equation, including the answer.

The tests are arranged so that you can easily locate the area of difficulty for each child. Time should be devoted to reteaching before proceeding further. Th lessons preceding these tests may be used. It is a goo plan to organize the children into groups for such re teaching. Children who know the basic facts should b excused from the review. Let them work on other subje matter.



I At the school party, there were just enough boys to make 2 teams of 9 each for baseball. How many boys were at the party?

J Four children brought balloons to the party. Each child brought 9 balloons. How many balloons in all did the children bring?

K There were 5 rows of milk bottles on a table. Each row had 7 bottles of milk in it. How many bottles of milk were on the table?

L The children drew pictures to put on 3 walls of their classroom. They drew 7 pictures for each wall. In all, how many pictures did they draw?

M Mary brought cookies and put them on 4 plates. She put 6 cookies on each plate. How many cookies had she brought?

N Jack brought 3 boxes of games. There were 4 games in each box. How many games did he bring?

O After the party, Ann collected empty plates from 4 tables. She got 7 plates from each table. How many plates did she collect altogether?

P Five cars came to take the children home. Jim counted all the children and said, "If each car can take 6 children, we can all ride." How many children did Jim count?

Checking up

Test 1	1	Test 2	2	Test 3	3	Test 4	4
A	4×3=	A	2×9=	A	4×5=	A	6×6=
B	3×2=	B	3×5=	B	6×4=	B	7×4=
C	2×5=	C	6×3=	C	7×3=	C	5×6=
D	2×2=	D	2×7=	D	5×5=	D	3×9=
E	6×2=	E	4×4=	E	4×6=	E	8×4=
F	3×3=	F	7×2=	F	5×4=	F	4×9=
G	2×3=	G	9×2=	G	8×3=	G	6×5=
H	4×2=	H	5×3=	H	3×7=	H	9×4=
I	3×4=	I	8×2=	I	9×3=	I	5×7=
J	2×6=	J	3×6=	J	6×3=	J	4×8=
K	2×4=	K	2×8=	K	3×9=	K	7×5=
L	5×2=	L	3×5=	L	3×8=	L	4×7=

End-of-block tests on basic multiplication facts with products up to and including 36 53

53

1 Test on the multiplication basic facts throug the 12 group
2 Test on the multiplication basic facts for th 14 to 18 groups
3 Test on the multiplication basic facts for th 20 to 27 groups
4 Test on the multiplication basic facts for th 27 to 36 groups

54 Thinking straight; Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns a short-cut method of regrouping numbers to use when subtraction involves internal zeros in the minuend. He reviews his knowledge of addition and subtraction of two-figure, three-figure, and four-figure numbers and of the multiplication basic facts for the numbers from 20 to 36.

Vocabulary

New words page 54 such*, ready*

Comments

The "Thinking straight" exercise presented here is merely a means of showing the child a short cut for subtracting from large numbers that involve internal zeros. In general, zero has been treated as just another numeral, and the usual difficulties of "subtracting from zero" do not arise. The child already has sufficient knowledge of the number system to perform the regrouping of numbers required in this exercise.

You may find it necessary to work out other examples to help the children understand the short cut. It is important that every child be given an opportunity to regroup numbers in the way shown before working Exercises A to G. Children who need to write out the changes that occur in the numerals as shown in the example in the book should be permitted to do so.

Answers

Thinking straight:

(block 1)	(block 2)	
A 14 ones	A 1735	F 154
B 500 tens, 17 ones	B 1479	G 6540
C 2 ones, 299 tens	C 4265	
D 700 tens, 699 tens	D 4618	
E 100 tens, 99 tens	E 2306	

Keeping skillful:

(block 1)			(block 2)		
A 89	E 1186	I 309	A 108	E 797	I 172
B 25	F 824	J 126	B 113	F 402	J 67
C 220	G 926	K 66	C 572	G 1426	K 1400
D 107	H 536		D 1868	H 1428	

Thinking straight

Sometimes you will need to subtract from such numbers as 6003 or 4008 or 7000. We will subtract 429 from 6003.

6003 / 429 — 1 Before you can subtract 9 ones, you must have more ones. Where can you get more ones?

6003 / 429 — 2 Think of 6003 as 600 tens 3 ones.

599 13 / 6003 / 429 — 3 Then take one of the 600 tens and put it with the ones. Now you have 599 tens and 13 ones. You are ready to subtract.

5574

A 2004 = 200 tens 4 ones, or 199 tens ▒ ones — 4

B 5007 = ▒ tens 7 ones, or 499 tens ▒ ones

C 3002 = 300 tens ▒ ones, or ▒ tens 12 ones

D 7000 = ▒ tens, or ▒ tens 10 ones

E 1005 = ▒ tens 5 ones, or ▒ tens 15 ones

A Subtract 268 from 2003.

B 4006 − 2527 = ▒ — 5

C 9000 − 4735 = ▒

D Subtract 389 from 5007.

E 8001 − 5695 = ▒

F 7000 − 6846 = ▒

G 8009 − 1469 = ▒

Keeping skillful

A Add 54 to 35. — 6

B Subtract 12 from 37.

C Add 23 to 197.

D Subtract 43 from 150.

E Subtract 1695 from 2881.

F Add 316 to 508.

G Add 180 to 746.

H Subtract 205 from 741.

I Add 79 to 230.

J Subtract 310 from 436.

K Add 45 to 21.

A 26 + 35 + 47 = ▒		A 4 × 7 = ▒ — 7
B 195 − 82 = ▒ — 6		B 6 × 3 = ▒
C 504 + 68 = ▒		C 5 × 6 = ▒
D 6700 − 4832 = ▒		D 3 × 8 = ▒
E 530 + 267 = ▒		E 9 × 4 = ▒
F 750 − 348 = ▒		F 6 × 6 = ▒
G 608 + 327 + 491 = ▒		G 4 × 5 = ▒
H 5002 − 3574 = ▒		H 5 × 7 = ▒
I 41 + 73 + 58 = ▒		I 8 × 4 = ▒
J 156 − 89 = ▒		J 7 × 3 = ▒
K 533 + 164 + 703 = ▒		K 4 × 6 = ▒

54

1 Draw attention to the need for more ones and to the fact that there are no tens or hundreds. Discuss the possibility of using one of the thousands.

2 Talk about the number 6003 as 6 thousands 3 ones, as 60 hundreds 3 ones, and as 600 tens 3 ones.

3 Be sure the children understand that 599 tens 13 ones equal 600 tens 3 ones. Explain why 600 and 3 are crossed out.

4 First have the children respond orally. Then direct them to write the numbers. Next have them cross out the numerals and write the regroupings above, as in the example.

5 Let children work independently.

6 Direct the children to copy the exercises in computational form and to find the answers. Supply answers and have the children rework exercises that are wrong.

7 These basic facts may be used for both oral and written work.

55-59 Looking back

Expanded Notes for this lesson are on pages 261-263.

Objectives

The child reviews the division basic facts for the 4 to 18 groups (the basic facts with dividends of 18 or less).

Vocabulary

New words page 55 division, surprise*; page 57 signals*; page 58 lights*

Comments

This lesson reviews the division basic facts that were taught in Grades 2 and 3 and the underlying concepts involved in division.

Page 55 begins the review of the division basic facts that were taught in Grade 2 and retaught in Grade 3. These simple basic facts are used to reintroduce the child to divisive actions. The pictures on this page show actual physical separation of objects into equal groups so the child can easily "see" the nature of divisive action. On page 56, and the following pages in this lesson, the division basic facts taught in Grade 3 are reviewed. On these pages, instead of seeing objects physically separated into equal groups, the child must imagine that such divisive action has occurred—that the total group has been separated into equal groups, as indicated by the rings.

These division basic facts are presented in situations in which the size of the equal groups is known and in which the number of equal groups is to be found. Since division, computationally, consists of a repeated taking away of equal groups, this is the most direct type of divisive situation, and the most appropriate to use in presenting division basic facts.

Care should be taken throughout this review that the child does not confuse the actions involved in division and subtraction. It is important to emphasize that in subtraction a part of a total group is taken away, and that primary interest is then focused on the group that remains. In division, separating action also occurs, but the separated groups are not taken away. Attention is centered equally on all the groups, whether the primary interest in the particular situation is in the number of groups or in the number of objects in each group. Furthermore, the child should understand that the equality of the groups is essential to the divisive situation bu is not a necessary, or significant, condition in subtraction

The computational form of division appears on pag 55 and in practice exercises on page 59. There is n need to stress the form at this point, since this lesso deals only with basic facts, and actual computation i unnecessary. The form is presented here so that the chil will learn to recognize it and know what to do with i if he encounters it in tests or exercises. Later, when h comes to examples involving division beyond the basi facts, he will learn to use the computational form as a way to write his work so that he can process the num bers.

Since all the required answers involve basic facts, n answers are included for this lesson.

Looking back

This lesson will help you remember what you learned last year about division and how to divide numbers from 4 to 18.

A clerk in a toy store is going to put 10 cars into boxes. He will put 2 cars into each box. How many groups of cars will he have? How many boxes will he need?

10 divided into groups of 2 makes ■ groups.
10 divided by 2 = ■
Divide 10 by 2. 10 ÷ 2 = ■

2)10

The clerk is also making surprise packages. He will put 3 puzzles into each bag. How many bags will he need for 9 puzzles?

9 divided into groups of 3 makes ■ groups.
9 divided by 3 = ■
Divide 9 by 3. 9 ÷ 3 = ■

A 6 ÷ 2 = ■
B 10 ÷ 5 = ■
C 4 ÷ 2 = ■
D 9 ÷ 3 = ■
E 8 ÷ 4 = ■
F 6 ÷ 3 = ■
G 10 ÷ 2 = ■
H 8 ÷ 2 = ■

There are 12 cars in all.
The 12 cars are divided into groups of ■.
There are ■ groups of 2.
12 ÷ 2 = ■

Now the 12 cars are divided into groups of ■.
There are ■ groups of 6.
12 ÷ 6 = ■

Now the 12 cars are divided into groups of ■.
There are ■ groups of 3.
12 ÷ 3 = ■

Now the 12 cars are divided into groups of ■.
There are ■ groups of 4.
12 ÷ 4 = ■

A 12 ÷ 4 = ■
B 10 ÷ 2 = ■
C 12 ÷ 2 = ■
D 10 ÷ 5 = ■
E 6 ÷ 3 = ■
F 8 ÷ 4 = ■
G 12 ÷ 6 = ■
H 6 ÷ 2 = ■
I 12 ÷ 3 = ■
J 4 ÷ 2 = ■
K 12 ÷ 6 = ■
L 10 ÷ 2 = ■
M 8 ÷ 4 = ■
N 12 ÷ 4 = ■
O 6 ÷ 3 = ■
P Divide 8 by 2.
Q 9 divided by 3 = ■
R 12 = ■ groups of 6
S 10 = ■ groups of 2
T Divide 12 by 4.

55

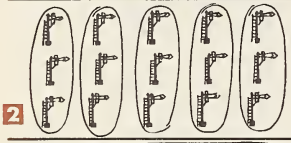
1. Tell the children to look at Movie A and read this problem. Let them tell what has happened in Scenes 1 and 2 of the movie. Point out that Scene 1 shows more than 5 boxes because at first we do not know how many boxes the clerk will need. Call on someone to read the problem and answer the questions.
2. Call on pupils to read and complete the statements. Make sure they refer to the picture. Explain that these statements are different ways of stating and writing division.
3. Have the children refer to Movie B as they read the problem. Call on someone to tell what has happened in Scenes 1 and 2 and to answer the question. Ask another pupil to read the division statements after the problem and supply the missing numbers.
4. Call on children to complete these equations orally. Any child who cannot give immediate answers needs to relearn these basic facts through experiences with objects.

56

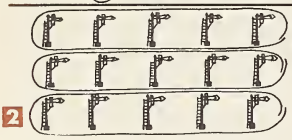
1. Direct pupils to refer to Picture C and read the text. Have them note how many cars there are in all, how many are in each group, and how many equal groups there are. Explain that the rings in the picture help them to imagine the group of 12 as separated into groups of 2. Children who have difficulty understanding what happens should arrange 12 objects on their desks, then practice separating them into groups of 2 and counting the number of groups. Call on someone to read the text aloud, supplying the missing numbers.
2. Proceed in the same manner with this picture and its text.
3. Ask the children to write these equations with the answers, or have them write only the identifying letters and the answers. For Exercises P to T you may ask them to write the statements in equation form. If you prefer, you may have them answer the exercises orally.

G There are 14 cars in all.
The 14 cars are divided into groups of ■.
There are ■ groups of 2.
14 ÷ 2 = ■

H Now the 14 cars are divided into groups of ■.
There are ■ groups of 7.
14 ÷ 7 = ■

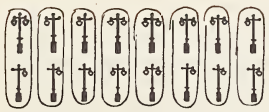


I There are 15 signals in all.
The 15 signals are divided into groups of ■.
There are ■ groups of 3.
15 ÷ 3 = ■

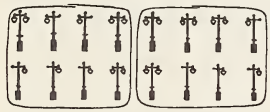


J Now the 15 signals are divided into groups of ■.
There are ■ groups of 5.
15 ÷ 5 = ■

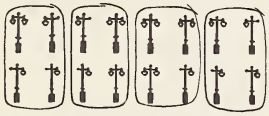
A	14 ÷ 7 = ■	F	12 ÷ 2 = ■	K	8 ÷ 4 = ■	P	Divide 15 by 3.
B	15 ÷ 3 = ■	G	12 ÷ 6 = ■	L	6 ÷ 2 = ■	Q	14 divided by 7 = ■
C	15 ÷ 5 = ■	H	10 ÷ 2 = ■	M	9 ÷ 3 = ■	R	15 = ■ groups of 5
D	14 ÷ 2 = ■	I	12 ÷ 3 = ■	N	8 ÷ 2 = ■	S	Divide 12 by 3.
E	12 ÷ 4 = ■	J	10 ÷ 5 = ■	O	6 ÷ 3 = ■	T	14 = ■ groups of 2



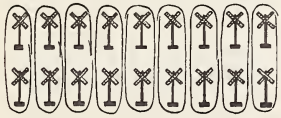
K There are 16 lights in all.
The 16 lights are divided into groups of ■.
There are ■ groups of 2.
16 ÷ 2 = ■



L Now the 16 lights are divided into groups of ■.
There are ■ groups of 8.
16 ÷ 8 = ■



M Now the 16 lights are divided into groups of ■.
There are ■ groups of 4.
16 ÷ 4 = ■



N There are 18 signs in all.
The 18 signs are divided into groups of ■.
There are ■ groups of 2.
18 ÷ 2 = ■

O Now the 18 signs are divided into groups of ■.
There are ■ groups of 9.
18 ÷ 9 = ■

57

1 Tell the pupils to refer to Picture G and read the text. Make sure they note the total number of cars, how many are in each group, and the number of equal groups. Remind them that the rings will help them imagine the group of 14 as separated into groups of 2. Call on someone to read the text aloud, saying the missing numbers. Children who have difficulty understanding what happens should arrange 14 objects on their desks, rearrange them into groups of 2, and count the number of groups.

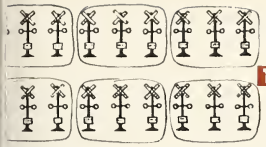
2 Proceed in the same way with this picture and its text.

3 Have the children write the equations with answers, or the identifying letters and answers only. For Exercises P to T you may ask them to write the statements in equation form. If you prefer, have them take turns answering the exercises orally.

58

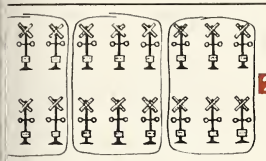
1 Direct the children to read these statements and to refer to the picture as they read. Ask questions that lead them to note how many lights there are in all, how many are in each group, and the number of equal groups. Remind them that the rings help them see the 16 lights divided into equal groups. Call on a pupil to read and complete the statements in the text. Slow learners may need to work with objects at their desks, rearranging a group of 16 into groups of 2 and counting the number of groups.

2 Proceed in the same way with this picture and text.



P There are 18 signs in all.
Now the 18 signs are divided into groups of ▪.
There are ▪ groups of 3.
18 ÷ 3 = ▪

1



Q Now the 18 signs are divided into groups of ▪.
There are ▪ groups of 6.
18 ÷ 6 = ▪

2

16 ÷ 4 = ▪
18 ÷ 3 = ▪
14 ÷ 7 = ▪
16 ÷ 2 = ▪
15 ÷ 5 = ▪
18 ÷ 9 = ▪
12 ÷ 4 = ▪
14 ÷ 2 = ▪
12 ÷ 6 = ▪
18 ÷ 6 = ▪
16 ÷ 8 = ▪
12 ÷ 2 = ▪
15 ÷ 3 = ▪
18 ÷ 2 = ▪
12 ÷ 3 = ▪

4

A Divide 15 by 3.
B 14 = ▪ groups of 2
C 18 divided by 2 = ▪
D Divide 16 by 4.
E 10 = ▪ groups of 2
F Divide 18 by 9.
G 16 = ▪ groups of 2
H 15 divided by 5 = ▪
I Divide 18 by 3.
J 8 divided by 2 = ▪
K 9 = ▪ groups of 3
L 18 = ▪ groups of 6
M Divide 12 by 3.
N 16 divided by 8 = ▪
O Divide 12 by 6.

5

A	B	C	D
▪	▪	▪	▪
2)18	6)12	3)6	4)16
E	F	G	H
▪	▪	▪	▪
7)14	3)18	4)12	8)16
I	J	K	L
▪	▪	▪	▪
6)18	4)8	2)16	9)18
M	N	O	P
▪	▪	▪	▪
5)10	2)14	3)9	2)8

Now you should be able to divide numbers up to 18.

59

59

1 Tell the pupils to look at Picture P and read the text. Remind them that the rings will help them see the number of equal groups. Call on someone to read the statements aloud, saying the missing numbers.

2 Proceed in the same way with this picture and text.

3 This group of exercises includes all the division basic facts for the 12 to 18 groups. Call on pupils at random to give the answers orally. Then you may ask the class to write either the whole equations or the identifying letters and answers only.

4 Call on various children to complete these exercises orally. Then you may ask them to write an equation for each of them and include the answer.

5 Let the children take turns supplying the answers orally first. Then have them write all the exercises on paper, putting in the answers.

60-65 Looking back

Expanded Notes for this lesson are on pages 263-264.

Objectives

The child reviews the division basic facts for the 20 to 36 groups (the basic facts with dividends larger than 18 and smaller than 40).

Vocabulary

New words page 60 rolling*, pins*; page 63 cameras*, flashlights*

Comments

This lesson completes the review of the division basic facts taught in Grade 3. Note that the dividends of all the basic facts reviewed in this lesson include two or more groups of 10. To enable the child to see a total group of 20 or more objects easily without counting, the objects in the pictures are arranged in horizontal rows of ten.

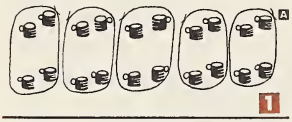
As in the preceding lesson, instead of seeing objects physically separated into equal groups, the child must visualize the total group and then imagine that it has been separated into smaller equal groups. Rings are again used to indicate the equal groups into which the total group is separated.

The division basic facts for groups of 20 to 36 are presented pictorially. The exercises at the bottom of each page provide practice on the basic facts taught on that page and on preceding pages.

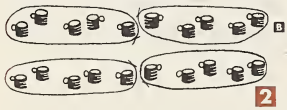
Since all the required answers involve basic facts, no answers are included for this lesson.

Looking back

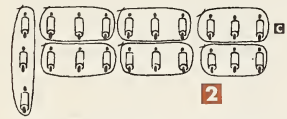
This lesson will help you remember how to divide numbers from 20 to 36.



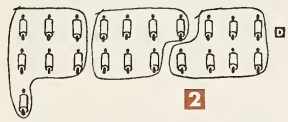
There are 20 measuring cups in all.
The 20 cups are divided into groups of ☐.
There are ☐ groups of 4.
20 ÷ 4 = ☐



Now the 20 cups are divided into groups of ☐.
There are ☐ groups of 5.
20 ÷ 5 = ☐



There are 21 rolling pins in all.
The 21 rolling pins are divided into groups of ☐.
There are ☐ groups of 3.
21 ÷ 3 = ☐



Now the 21 rolling pins are divided into groups of ☐.
There are ☐ groups of 7.
21 ÷ 7 = ☐

3

A 21 ÷ 3 = ☐
B 20 ÷ 5 = ☐
C 21 ÷ 7 = ☐
D 20 ÷ 4 = ☐
E 9 ÷ 3 = ☐
F 10 ÷ 2 = ☐
G 12 ÷ 3 = ☐
H 18 ÷ 9 = ☐
I 16 ÷ 4 = ☐
J 8 ÷ 2 = ☐
K 14 ÷ 7 = ☐
L 15 ÷ 3 = ☐
M 21 = ☐ groups of 7
N Divide 20 by 4.
O 20 = ☐ groups of 5
P Divide 21 by 3.

There are 24 cooky cutters in all.
The 24 cooky cutters are divided into groups of ☐.
There are ☐ groups of 3.
24 ÷ 3 = ☐

Now the 24 cooky cutters are divided into groups of ☐.
There are ☐ groups of 8.
24 ÷ 8 = ☐

Now the 24 cooky cutters are divided into groups of ☐.
There are ☐ groups of 4.
24 ÷ 4 = ☐

Now the 24 cooky cutters are divided into groups of ☐.
There are ☐ groups of 6.
24 ÷ 6 = ☐

3

A 24 ÷ 4 = ☐
B 24 ÷ 6 = ☐
C 24 ÷ 8 = ☐
D 24 ÷ 3 = ☐
E 20 ÷ 4 = ☐
F 20 ÷ 5 = ☐
G 21 ÷ 3 = ☐
H 21 ÷ 7 = ☐
I 16 ÷ 8 = ☐
J 18 ÷ 6 = ☐
K 15 ÷ 3 = ☐
L 6 ÷ 2 = ☐
M Divide 24 by 8.
N 24 = ☐ groups of 4
O 24 divided by 3 = ☐
P Divide 20 by 5.

60

1 Tell the children to look at Picture A and read the text. Have them note how many cups there are in all, how many there are in each group, and how many equal groups there are. Remind them that the rings in the picture help them to imagine the group of 20 as separated into groups of 4. Pupils who have difficulty understanding what happens should group 20 objects on their desks, rearrange them into groups of 4, and count the number of groups. Call on someone to read and complete the statements in the text.

2 Work in the same way with this picture and its text.

3 The pupils may take turns answering these exercises orally first. Then you may ask them to write the identifying letters with answers on paper, or, if you prefer, to write out the complete equation for each exercise. You may ask them to write Exercises M to P in equation form.

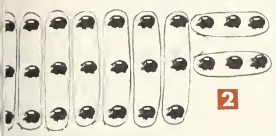
61

1 Tell the pupils to refer to Picture E and read the text. Make sure they note the total number of cutters, how many are in each group, and the number of equal groups. Remind them that the rings help them see the 24 cutters divided into equal groups. Call on a pupil to read the text aloud, saying the missing numbers. Slow learners may need to work with objects at their desks, rearranging a group of 24 into groups of 3 and counting the number of groups.

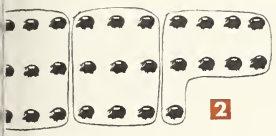
2 Proceed in the same way with this picture and its text.

3 Call on children in random order to answer the exercises orally. Then you may have them write the complete equations with answers or the identifying letters and answers only. For Exercises M to P ask them to write the statements in equation form.

I There are 25 plants in all.
The 25 plants are divided into groups of ▪.
There are ▪ groups of 5.
25 ÷ 5 = ▪



J There are 27 banks in all.
The 27 banks are divided into groups of ▪.
There are ▪ groups of 3.
27 ÷ 3 = ▪



K Now the 27 banks are divided into groups of ▪.
There are ▪ groups of 9.
27 ÷ 9 = ▪

3

A 27 ÷ 9 = ▪
B 27 ÷ 3 = ▪
C 25 ÷ 5 = ▪
D 24 ÷ 8 = ▪
E 20 ÷ 5 = ▪
F 24 ÷ 3 = ▪
G 24 ÷ 6 = ▪
H 20 ÷ 4 = ▪
I 21 ÷ 7 = ▪
J 24 ÷ 4 = ▪

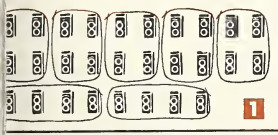
K 21 ÷ 3 = ▪
L 20 ÷ 4 = ▪
M 18 ÷ 2 = ▪
N 18 ÷ 6 = ▪
O 20 ÷ 5 = ▪
P 18 ÷ 9 = ▪
Q 18 ÷ 3 = ▪
R 14 ÷ 2 = ▪
S 24 ÷ 6 = ▪
T 15 ÷ 3 = ▪

4

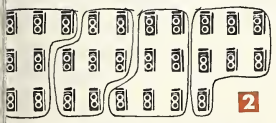
A 18 = ▪ groups of 9
B Divide 14 by 7.
C 21 divided by 3 = ▪
D 24 divided by 6 = ▪
E Divide 21 by 7.
F 24 = ▪ groups of 4
G 18 divided by 6 = ▪
H Divide 14 by 2.
I 25 = ▪ groups of 5
J Divide 18 by 2.

5

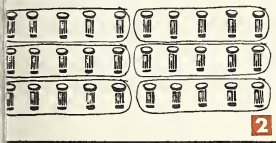
A 12 ÷ 4 = ▪
B 14 ÷ 7 = ▪
C 27 ÷ 9 = ▪
D 16 ÷ 4 = ▪
E 9 ÷ 3 = ▪
F 12 ÷ 3 = ▪
G 16 ÷ 8 = ▪
H 15 ÷ 5 = ▪
I 27 ÷ 3 = ▪
J 8 ÷ 4 = ▪



L There are 28 cameras in all.
The 28 cameras are divided into groups of ▪.
There are ▪ groups of 4.
28 ÷ 4 = ▪



M Now the 28 cameras are divided into groups of ▪.
There are ▪ groups of 7.
28 ÷ 7 = ▪



N There are 30 flashlights in all.
The 30 flashlights are divided into groups of ▪.
There are ▪ groups of 5.
30 ÷ 5 = ▪

O Now the 30 flashlights are divided into groups of ▪.
There are ▪ groups of 6.
30 ÷ 6 = ▪

3

A 30 ÷ 5 = ▪
B 28 ÷ 7 = ▪
C 30 ÷ 6 = ▪
D 28 ÷ 4 = ▪
E 20 ÷ 5 = ▪

F 21 ÷ 3 = ▪
G 25 ÷ 5 = ▪
H 24 ÷ 8 = ▪
I 27 ÷ 9 = ▪
J 24 ÷ 3 = ▪

K 24 ÷ 6 = ▪
L 16 ÷ 2 = ▪
M 27 ÷ 3 = ▪
N 15 ÷ 5 = ▪
O 21 ÷ 7 = ▪

P Divide 30 by 6.
Q 28 divided by 4 = ▪
R 30 = ▪ groups of 5
S Divide 28 by 7.
T 16 = ▪ groups of 8

62

1 Tell the pupils to look at Picture I and read the text. Remind them that the rings will help them see the number of equal groups. Call on someone to read the statements aloud, saying the missing numbers. Help slow learners carry out the divisive action with real objects at their desks.

2 Proceed in the same way with this picture and its text.

3 Call on pupils to give the answers orally. Then you may ask the class to write out either the complete equations with answers or the identifying letters and answers only.

4 Call on various children to complete these exercises orally. Then ask them to write a complete equation for each statement on their papers.

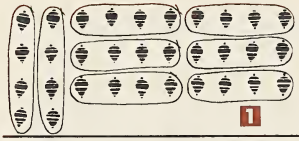
5 These exercises may be answered orally, written on paper, or both.

63

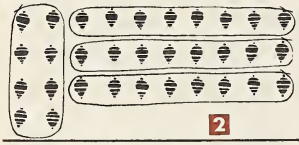
1 Direct the children to look at Picture L and read the text. Have them note how many cameras there are in all, how many are in each group, and how many equal groups there are. Remind them that the rings in the picture help them to imagine the group of 28 as separated into groups of 4. Pupils who have difficulty understanding what happens should place 28 objects on their desks, rearrange them into groups of 4, and count the number of groups. Call on someone to read and complete the statements in the text.

2 Work in the same way with this picture and its text.

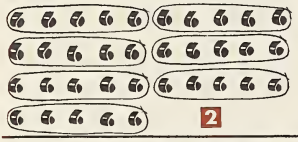
3 Call on various children to complete these exercises orally. Then you may ask them to write the equations with answers or write the identifying letters and answers only. They should write Exercises P to T as equations.



P There are 32 tops in all.
The 32 tops are divided into groups of ▪.
There are ▪ groups of 4.
32 ÷ 4 = ▪



Q Now the 32 tops are divided into groups of ▪.
There are ▪ groups of 8.
32 ÷ 8 = ▪



R There are 35 whistles in all.
The 35 whistles are divided into groups of ▪.
There are ▪ groups of 5.
35 ÷ 5 = ▪

S Now the 35 whistles are divided into groups of ▪.
There are ▪ groups of 7.
35 ÷ 7 = ▪

A 35 ÷ 5 = ▪
B 32 ÷ 8 = ▪
C 35 ÷ 7 = ▪
D 30 ÷ 5 = ▪
E 32 ÷ 4 = ▪
F 21 ÷ 7 = ▪
G 27 ÷ 9 = ▪
H 20 ÷ 4 = ▪
I 24 ÷ 4 = ▪
J 30 ÷ 6 = ▪
K 16 ÷ 8 = ▪
L 12 ÷ 3 = ▪
M 25 ÷ 5 = ▪
N 28 ÷ 7 = ▪
O 18 ÷ 6 = ▪
P 32 = ▪ groups of 8
Q 32 divided by 4 = ▪
R 35 = ▪ groups of 7
S Divide 35 by 5.
T 27 divided by 3 = ▪

64

T There are 36 balls in all.
The 36 balls are divided into groups of ▪.
There are ▪ groups of 4.
36 ÷ 4 = ▪

U Now the 36 balls are divided into groups of ▪.
There are ▪ groups of 9.
36 ÷ 9 = ▪

V Now the 36 balls are divided into groups of ▪.
There are ▪ groups of 6.
36 ÷ 6 = ▪

A 32 ÷ 4 = ▪
B 36 ÷ 9 = ▪
C 36 ÷ 4 = ▪
D 24 ÷ 4 = ▪
E 30 ÷ 5 = ▪
F 28 ÷ 4 = ▪
G 30 ÷ 6 = ▪
H 35 ÷ 5 = ▪
I 24 ÷ 3 = ▪
J 35 ÷ 7 = ▪
K 21 ÷ 3 = ▪
L 32 ÷ 8 = ▪
M 36 = ▪ groups of 9
N 36 divided by 6 = ▪
O Divide 36 by 4.
P 27 = ▪ groups of 9

Now you should be able to divide numbers from 20 to 36.

64

1 Tell the pupils to refer to Picture P and read the text. Make sure they note the total number of tops, how many are in each group, and the number of equal groups. Remind them that the rings help them see the 32 tops divided into equal groups. Call on a pupil to read the text aloud, saying the missing numbers. Slow learners may need to work with objects at their desks, rearranging a group of 32 into groups of 4 and counting the number of groups.

2 Proceed in the same way with this picture and text.

3 Call on children to answer the exercises orally. Then you may have them write the equations with answers, or the identifying letters and answers only. For Exercises P to T you may ask them to write the statements in equation form.

65

1 Direct the children to read these statements and refer to the picture. Ask questions that lead them to note how many balls there are in all, how many are in each group, and the number of equal groups. Remind them that the rings will help them see the number of equal groups. Call on someone to read the statements aloud, saying the missing numbers. Help slow learners carry out the divisive action with real objects at their desks, if necessary.

2 Work in the same way with this picture and its text.

3 Let the children take turns answering these exercises orally. Then you may ask them to write the equations with answers, or the identifying letters and answers only. For Exercises M to P ask them to write the statements in equation form.

66-67 Using arithmetic

Expanded Notes for this lesson are on pages 264-265.

Objectives

The child learns to make equations to use in solving problems that involve divisive situations in which the number of equal groups must be found.

Vocabulary

New words page 66 worth*, tickets*, hamburger, buns; page 67 sale

Comments

The division basic facts just reviewed are put to use in solving the problems presented on pages 66 and 67.

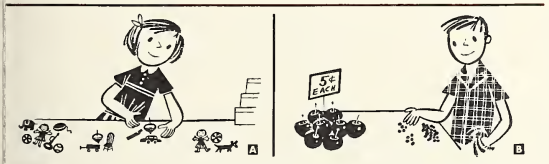
From their work in the two previous lessons on division, children should know that in a divisive situation a group is separated into equal smaller groups. In this lesson they learn to put the facts described in a verbal problem into arithmetic symbols and make an equation. They should learn to put the numerals that stand for the total original group at the left of the division sign, the numeral that stands for the size of the equal groups into which the total is to be separated or divided at the right of the division sign, and to put on the right side of the equals sign the screen, which represents the number of equal groups and which is unknown. On later pages they will review divisive situations in which the screen is used in the equation to indicate that the size of the equal groups is to be found. (See pages 120-123 of Book 4.)

Help is provided for the first three problems on page 66, and the equations are given for the first two. Be sure the children think in terms of *groups*. Frequently they will make the transition from "groups" to "boxes," "apples," etc. Careful teaching of problems like Problem A and work with objects should help them.

Answers

C $16 \div 8 = [2]$	H $21 \div 3 = [7]$	M $32 \div 8 = [4]$
D $20 \div 5 = [4]$	I $30 \div 6 = [5]$	N $15 \div 5 = [3]$
E $30 \div 5 = [6]$	J $27 \div 9 = [3]$	O $28 \div 4 = [7]$
F $36 \div 4 = [9]$	K $35 \div 7 = [5]$	P $18 \div 6 = [3]$
G $36 \div 6 = [6]$	L $27 \div 3 = [9]$	Q $25 \div 5 = [5]$

Using arithmetic



A Ann made surprise packages for a school party. She had 15 toys. She wanted to put 3 toys in each box. How many boxes did she need? 1

THINK Ann put the toys in groups of 3. $15 \div 3 = \square$. There were $\square$ groups of 3. Ann needed 1 box for each group. She needed $\square$ boxes in all. 2

B Tom spent 35¢ for apples for the school party. The apples that he bought cost 5¢ each. How many of these apples did he buy? 3

THINK With each group of 5 pennies, Tom could buy 1 apple. $35 \div 5 = \square$ 4

C Ann bought a pound of nuts for the party. At the store, nuts were sold in 8-ounce cans. How many cans did she buy? 5

THINK 1 pound = how many ounces?

D John had 20¢ to spend for candy bars for the party. How many 5-cent candy bars could he have bought? 6

E Bill sold 30¢ worth of tickets for the school party. Bill sold the tickets for 5¢ each. How many tickets did he sell?

F Sue had to buy 36 cupcakes. They were in packages of 4. How many packages should she have bought?

G Sue also had to buy 36 hamburger buns. The buns were in packages of 6. How many packages of buns should she have bought?

H At the toy store, Jim bought some 3-cent pencils for the party. How many pencils did he buy for 21¢?

I Jack and Don went to the toy store to buy 30¢ worth of games. How many 6-cent games could they buy?

66

1 Have the pupils read the four-line problem and relate it to Picture A. Get the children to observe that Ann is putting the toys into groups of 3. Let them conclude that she will need as many boxes as she has groups of 3.

2 Read this explanatory material and relate the numbers in the equation to the problem and picture.

3 Proceed in the same way with Problem B and Picture B. Let the children conclude that Tom can buy as many apples as he has groups of 5 pennies.

4 Relate the numbers in the equation to the problem and picture.

5 Discuss this problem and make the equation. Let the children conclude that a pound should be thought of as two groups of 8 ounces.

6 Direct the children to work independently on Problems D to I (J to Q on page 67). They should first make each equation with the screen and then rewrite it with the answer.

J At the toy store, the clerk was putting 27 toy firemen in rows. She put 9 firemen in each row. How many rows did she make? 1

K A sign said that the toy firemen cost 7¢ apiece. How many of them could Jack have bought with 35¢?

L Carol wanted to buy 27 balloons. At the toy store, the balloons were sold in packages of 3. How many of these packages should Carol have bought?

M Don went to the store to buy toy boats. He had 32¢. He saw some boats that cost 8¢ each. He could have bought how many of them with his 32¢?

N Bob sold 15¢ worth of tickets for the school party. The tickets were 5¢ each. How many tickets did Bob sell?

O 28 children went to the dime store in groups of 4. How many groups went to the dime store?

P Ellen saw some flowers for sale. They were in bunches of 6. She needed 18 flowers for the party. How many bunches should she have bought?

Q The children bought 25 different things at the dime store. The clerk put the things they bought into bags. She put 5 things in each bag. She used how many bags? 2

Checking up

Test 1	Test 2	Test 3	Test 4
A 12 ÷ 2 = ☐	A 16 ÷ 2 = ☐	A 24 ÷ 8 = ☐	A 36 ÷ 4 = ☐
B 8 ÷ 4 = ☐	B 14 ÷ 7 = ☐	B 20 ÷ 5 = ☐	B 27 ÷ 3 = ☐
C 4 ÷ 2 = ☐	C 16 ÷ 4 = ☐	C 21 ÷ 7 = ☐	C 35 ÷ 5 = ☐
D 12 ÷ 6 = ☐	D 15 ÷ 3 = ☐	D 25 ÷ 5 = ☐	D 32 ÷ 8 = ☐
E 9 ÷ 3 = ☐	E 18 ÷ 9 = ☐	E 20 ÷ 4 = ☐	E 28 ÷ 4 = ☐
F 10 ÷ 2 = ☐	F 14 ÷ 2 = ☐	F 24 ÷ 6 = ☐	F 36 ÷ 6 = ☐
G 12 ÷ 4 = ☐	G 18 ÷ 3 = ☐	G 21 ÷ 3 = ☐	G 28 ÷ 7 = ☐
H 6 ÷ 2 = ☐	H 15 ÷ 5 = ☐	H 24 ÷ 4 = ☐	H 36 ÷ 9 = ☐
I 10 ÷ 5 = ☐	I 18 ÷ 2 = ☐	I 27 ÷ 9 = ☐	I 30 ÷ 5 = ☐
J 6 ÷ 3 = ☐	J 16 ÷ 8 = ☐	J 24 ÷ 8 = ☐	J 32 ÷ 4 = ☐
K 8 ÷ 2 = ☐	K 18 ÷ 6 = ☐	K 20 ÷ 5 = ☐	K 35 ÷ 7 = ☐
L 12 ÷ 3 = ☐	L 14 ÷ 7 = ☐	L 24 ÷ 3 = ☐	L 30 ÷ 6 = ☐

End-of-block tests on division basic facts with dividends of 36 or less. 67

67

1 The children should continue to work independently on Problems J to Q, writing equations first with the screens and then with the answers.

2 When the children have finished, supply answers and have them check their work. Discuss the problems that caused trouble.

67 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child takes tests on the division basic facts for the groups through 36 (the division basic facts whose dividends are 36 or less).

Vocabulary

There are no new words.

Comments

These tests should not be treated as speed tests. Tell children to copy the labeling letter for each basic fact on their papers and write the answer. If you prefer, the children may write the entire equation and answer.

The tests are arranged so that you can easily locate the area of difficulty for each child. Time should be devoted to reteaching before proceeding further. The lessons preceding these tests should be used for reteaching. Or you may want to refer to the work on similar lessons in *Seeing through Arithmetic 3*.

Remember that future success in arithmetic depends on the child's knowing *all* of the basic facts, not most of them. Encourage each child to make a list of the ones he has trouble with. This list can be kept in a notebook or on a card. When the child no longer has trouble with a basic fact, it can be crossed off or erased. Encourage the child to persist until all items on his list are erased or crossed off.

See suggestions in Expanded Notes for page 17 on pages 244-245.

J At the toy store, the clerk was putting 27 toy firemen in rows. She put 9 firemen in each row. How many rows did she make?

K A sign said that the toy firemen cost 7¢ apiece. How many of them could Jack have bought with 35¢?

L Carol wanted to buy 27 balloons. At the toy store, the balloons were sold in packages of 3. How many of these packages should Carol have bought?

M Don went to the store to buy toy boats. He had 32¢. He saw some boats that cost 8¢ each. He could have bought how many of them with his 32¢?

N Bob sold 15¢ worth of tickets for the school party. The tickets were 5¢ each. How many tickets did Bob sell?

O 28 children went to the dime store in groups of 4. How many groups went to the dime store?

P Ellen saw some flowers for sale. They were in bunches of 6. She needed 18 flowers for the party. How many bunches should she have bought?

Q The children bought 25 different things at the dime store. The clerk put the things they bought into bags. She put 5 things in each bag. She used how many bags?

Checking up

Test 1	1	Test 2	2	Test 3	3	Test 4	4
J $12 \div 2 =$		A $16 \div 2 =$		A $24 \div 8 =$		A $36 \div 4 =$	
K $8 \div 4 =$		B $14 \div 7 =$		B $20 \div 5 =$		B $27 \div 3 =$	
L $4 \div 2 =$		C $16 \div 4 =$		C $21 \div 7 =$		C $35 \div 5 =$	
M $12 \div 6 =$		D $15 \div 3 =$		D $25 \div 5 =$		D $32 \div 8 =$	
N $9 \div 3 =$		E $18 \div 9 =$		E $20 \div 4 =$		E $28 \div 4 =$	
O $10 \div 2 =$		F $14 \div 2 =$		F $24 \div 6 =$		F $36 \div 6 =$	
P $12 \div 4 =$		G $18 \div 3 =$		G $21 \div 3 =$		G $28 \div 7 =$	
Q $6 \div 2 =$		H $15 \div 5 =$		H $24 \div 4 =$		H $36 \div 9 =$	
J $10 \div 5 =$		I $18 \div 2 =$		I $27 \div 9 =$		I $30 \div 5 =$	
K $6 \div 3 =$		J $16 \div 8 =$		J $24 \div 8 =$		J $32 \div 4 =$	
L $8 \div 2 =$		K $18 \div 6 =$		K $20 \div 5 =$		K $35 \div 7 =$	
M $12 \div 3 =$		L $14 \div 7 =$		L $24 \div 3 =$		L $30 \div 6 =$	

End-of-block tests on division basic facts with dividends of 36 or less 67

67

1 Test on the division basic facts for the 4 to 12 groups (reviewed on pages 55-56)
2 Test on the division basic facts for the 14 to 18 groups (reviewed on pages 57-59)
3 Test on the division basic facts for the 20 to 27 groups (reviewed on pages 60-62)
4 Test on the division basic facts for the 27 to 36 groups (reviewed on pages 62-65)

68-69 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices analyzing problems and selecting one of the four processes for use in the solution. He learns to visualize a problem situation from a description in words, to put it in equation form, and to solve it.

Vocabulary

New words page 68 rocking*, trucks*, sets*, magnet, exactly*; page 69 baby*, broke*

Comments

For the first time, a choice among all four processes (addition, subtraction, multiplication, and division) must be made by the children in finding solutions to a set of problems. Since many of the problems use the same numbers, clear visualizing of what happens and careful thinking through of the problem situation are necessary. Before a child attempts to solve a problem he should have clear imagery of the situation described.

Under traditional methods of teaching problem solving in arithmetic, children often rush into computational activity without really thinking about the problem. If, however, they first express the problem situation by writing an equation, the emphasis is (as it should be) primarily upon the thinking rather than upon the computation. Most of these problems involve only the basic facts, and if the problem is understood, the answer can therefore be given immediately. Nevertheless, insist that the children write the equations. The important thing at this stage is that the children learn orderly methods of attacking problems. If these methods are well learned, they will be available when the problems become more complex and when actual computation with larger numbers will be required.

A further advantage for requiring the equations to be made at this time is that they serve as an indication of the child's thinking. As such, they will be useful to you in appraising the child's understanding of the problem situation.

Answers

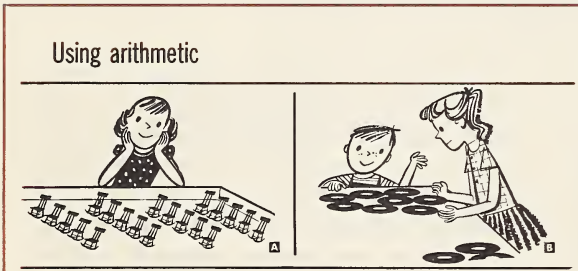
Given here is the equation necessary for understanding and solving each problem. The bracketed number represents the screen in the equation and shows the answer to be obtained.

Using arithmetic:

A $4\times5=[20]$	F $36-6=[30]$	K $6\times4=[24]$
B $32-8=[24]$	G $7\times5=[35]$	L $24-8=[16]$
C $25\div5=[5]$	H $7+5=[12]$	M $4\times3=[12]$
D $25+5=[30]$	I $24\div8=[3]$	N $27\div9=[3]$
E $36\div6=[6]$	J $4+3=[7]$	

Keeping skillful:

A 718	F 1817	J 54	N 3965	R 176
B 909	G 946	K 335	O 1409	S 750
C 997	H 687	L 18	P 1119	T 7621
D 253	I 877	M 101	Q 719	U 108
E 1610				



Using arithmetic

A In the toy store Carol saw 4 rows of small rocking chairs. There were 5 rocking chairs in each row. 1
How many rocking chairs did Carol see?
$4 \frown\!\frown 5 = \square$ 2

B Betty had 32 records. She gave 8 of them to her brother. How many records did Betty have then? 3
$32 \frown\!\frown 8 = \square$ 4

C Ann had 25 cents to spend for paper dolls. How many 5-cent paper dolls could she have bought with this money? 5
$25 \frown\!\frown 5 = \square$

D John had 25 baseball cards. His brother gave him 5 more cards. How many baseball cards did John have then?
$25 \frown\!\frown 5 = \square$ 6

E At the store some toy trucks came in boxes of 36. The clerk wanted to sell them in sets of 6. How many sets of 6 trucks could he make out of each box of 36?
$36 \frown\!\frown 6 = \square$

F Bob had 36 marbles. He gave 6 of them to Tom. How many marbles did Bob have then?
$36 \frown\!\frown 6 = \square$

G For 7 weeks Don saved 5¢ a week. Then he said to his mother that he had exactly enough money to buy a magnet that cost 35¢. Had Don saved enough money to buy the magnet?
$7 \frown\!\frown 5 = \square$

H Betty had 7 paper dolls. She bought 5 more paper dolls. How many paper dolls did Betty have then?
$7 \frown\!\frown 5 = \square$

68

1 Direct the pupils to read this problem and to look at Picture A. Ask: "How many chairs are there in each row? How many rows of 5 chairs are there?" Suggest that they imagine putting them into one big group. Ask: "Does this suggest adding or multiplying? 4 fives equal how many?" Help them see the 2 tens.

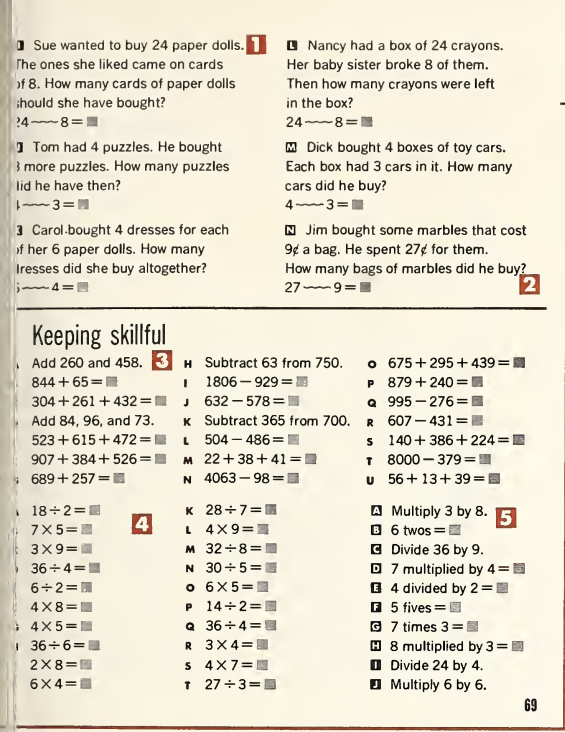
2 Now call attention to the equation. Ask what sign or word stands for multiplying. Ask a pupil to complete the equation and read it.

3 Have this problem read aloud and direct attention to Picture B. Ask what is happening in this picture and have the children relate it to the problem. Have them decide whether the situation is subtractive or divisive.

4 Ask what sign or word should go in the equation. Then have someone read the equation.

5 Have this problem read aloud. Help the pupils "see" or think of the 25¢ as divided into groups of 5¢. Let them complete the equation.

6 Direct the children to work independently.



I Sue wanted to buy 24 paper dolls. The ones she liked came on cards of 8. How many cards of paper dolls should she have bought?
24 ⟶ 8 = ■

J Tom had 4 puzzles. He bought 3 more puzzles. How many puzzles did he have then?
4 ⟶ 3 = ■

K Carol bought 4 dresses for each of her 6 paper dolls. How many dresses did she buy altogether?
6 ⟶ 4 = ■

L Nancy had a box of 24 crayons. Her baby sister broke 8 of them. Then how many crayons were left in the box?
24 ⟶ 8 = ■

M Dick bought 4 boxes of toy cars. Each box had 3 cars in it. How many cars did he buy?
4 ⟶ 3 = ■

N Jim bought some marbles that cost 9¢ a bag. He spent 27¢ for them. How many bags of marbles did he buy?
27 ⟶ 9 = ■

Keeping skillful

Add 260 and 458.
844 + 65 = ■
304 + 261 + 432 = ■
Add 84, 96, and 73.
523 + 615 + 472 = ■
907 + 384 + 526 = ■
689 + 257 = ■

H Subtract 63 from 750.
I 1806 − 929 = ■
J 632 − 578 = ■
K Subtract 365 from 700.
L 504 − 486 = ■
M 22 + 38 + 41 = ■
N 4063 − 98 = ■

O 675 + 295 + 439 = ■
P 879 + 240 = ■
Q 995 − 276 = ■
R 607 − 431 = ■
S 140 + 386 + 224 = ■
T 8000 − 379 = ■
U 56 + 13 + 39 = ■

18 ÷ 2 = ■
7 × 5 = ■
3 × 9 = ■
36 ÷ 4 = ■
6 ÷ 2 = ■
4 × 8 = ■
4 × 5 = ■
36 ÷ 6 = ■
2 × 8 = ■
6 × 4 = ■

K 28 ÷ 7 = ■
L 4 × 9 = ■
M 32 ÷ 8 = ■
N 30 ÷ 5 = ■
O 6 × 5 = ■
P 14 ÷ 2 = ■
Q 36 ÷ 4 = ■
R 3 × 4 = ■
S 4 × 7 = ■
T 27 ÷ 3 = ■

A Multiply 3 by 8.
B 6 twos = ■
C Divide 36 by 9.
D 7 multiplied by 4 = ■
E 4 divided by 2 = ■
F 5 fives = ■
G 7 times 3 = ■
H 8 multiplied by 3 = ■
I Divide 24 by 4.
J Multiply 6 by 6.

69

69

1 Independent work should continue on Problems I to N, as on page 68.

2 When the children have completed their work, supply answers and let each child check his own work. Discuss the problems that caused difficulty. If necessary, let children show with objects what they think happened in a problem.

3 As a separate lesson, direct children to write the numbers in computational form and to find the answers. Supply answers and direct each child to correct his mistakes.

4 Use Exercises A to T orally. Since these are basic facts, children should be able to give answers quickly. They may also be assigned as written work.

5 Have children write the equations and answers for Exercises A to J.

70-73 Looking back

Expanded Notes for this lesson are on pages 266-267.

Objectives

The pupil reviews equivalent values for the nickel, dime, quarter, half dollar, and dollar. He practices organizing coins and bills into groups for counting. He counts money, and he uses methods of counting that are common in everyday life.

Vocabulary

There are no new words in this lesson.

Comments

Although our money system is one of the applications of our number system, it has some features that make it a poor device for teaching the number system. For example, the importance of 5 and 25 as units in the money system is contrary to the "tens" nature of the number system itself. Consequently, this program emphasizes a thorough understanding of the number system before developing skills in the understanding of monetary units.

The child's comprehension of a coin or bill is greatly increased if he has opportunities for handling real money or at least something that he can imagine is real money. If the class is a small one, the teacher may be able to provide enough real money for the group to work with. It is not necessary for every child to be provided with all the coins to be used. It is not advisable to ask the children to bring coins from home. Substitute or "play" money will serve the purpose if the use of real money is not feasible. With large classes, it will be helpful to have a supply of play money for each child to use. Rectangles representing bills may be cut from paper by the children and marked with large numerals. Denominations they will need for this lesson are: $1, $2, $5, and $10. For the coins, milk bottle caps may be trimmed to the desired size, or circles may be traced from real coins on thin cardboard or oaktag and then cut out and marked with their denominations.

In the book, coins and bills have been stylized to facilitate recognition of their respective denominations,

since children often find it hard to distinguish between pictures of actual money. The only reproductions of real money used in this lesson are on page 70, where the nickel and all the silver coins are reproduced in actual size. Government regulations prohibit the use of realistic pictures of paper money. For this reason it is important that real bills be shown to the children.

Equivalent values are reviewed on page 70. Note that below each photographed coin there are one or more pictures of an equivalent value in stylized coins of other denominations. Counting money is reviewed on pages 71-73. In the pictures that are used to teach counting, the child may count coins that are overlapped as one value: 5 overlapped pennies as 5, 2 overlapped nickels as 10, 4 overlapped quarters as one dollar, etc. The organization of a group of coins before counting, beginning with the larger coins and working through to the smaller coins, as is commonly done, should be carefully reviewed. Two nickels or five pennies may be grouped together. Counting of amounts in excess of one dollar by methods commonly used is taught on page 73.

Children should receive meaningful practice in counting by fives, tens, and twenty-fives, using real or stylized coins for this purpose. In the same way, they should practice counting by tens but beginning with 5 (5, 15, 25, 35, etc.).

Answers

Page 71:

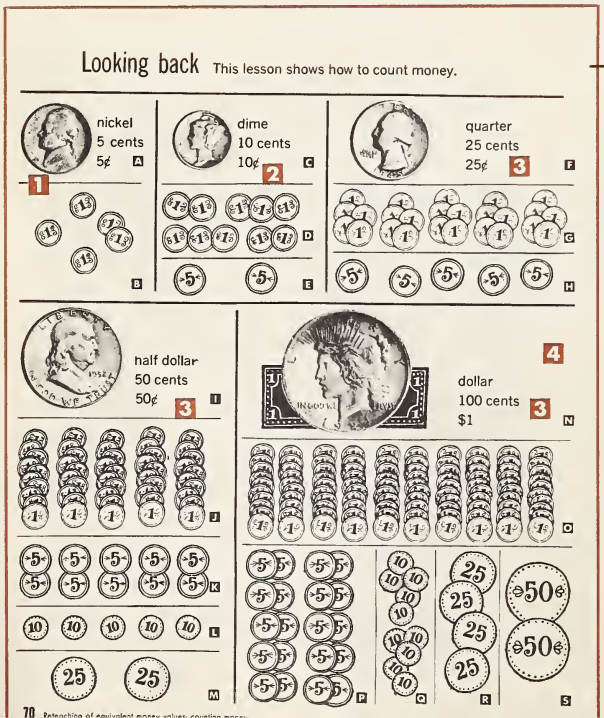
A	5	D	25¢	G	25	J	10	M	30	P	5
B	1; 5	E	50¢	H	5	K	50¢	N	1; 5	Q	6
C	6	F	15	I	25¢	L	50	O	30¢	R	1

Page 72:

C	80¢	F	58¢	I	37¢	L	29¢	O	35¢	R	56¢
D	47¢	G	75¢	J	81¢	M	65¢	P	52¢	S	100¢
E	60¢	H	55¢	K	100¢	N	95¢	Q	86¢		

Page 73:

D	$2 and 73¢	F	$8 and 40¢	H	$21 and 6¢
E	$15 and 35¢	G	$10 and 71¢	I	$10 and 90¢



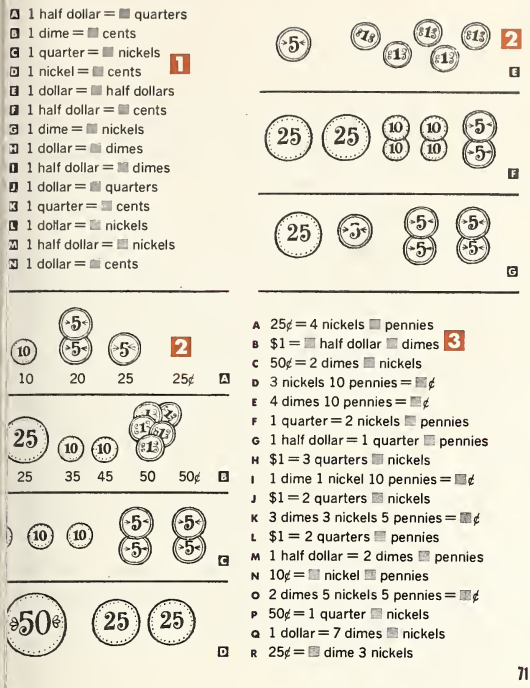
70

1 Direct attention to the picture of the nickel and compare it with a real nickel. Let the children discover that no combination of coins (except 5 pennies) equals a nickel. Discuss the three ways of writing this amount of money. Make a list of things that can be bought with a nickel.

2 Proceed in the same way with the dime. Let the children discover one other combination of coins that equals a dime, using real coins if possible.

3 Proceed in the same way with this coin. Be sure the children discover other combinations of coins that equal it.

4 Be sure to have at hand both a silver dollar and a paper dollar.

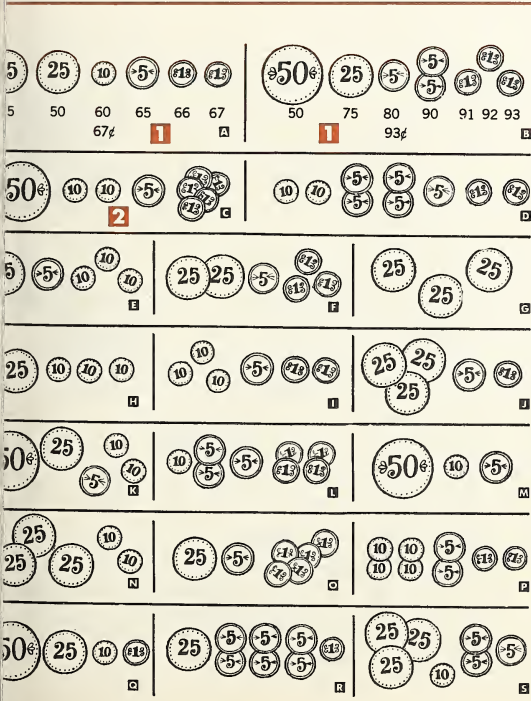

A 1 half dollar = ■ quarters
B 1 dime = ■ cents
C 1 quarter = ■ nickels
D 1 nickel = ■ cents
E 1 dollar = ■ half dollars
F 1 half dollar = ■ cents
G 1 dime = ■ nickels
H 1 dollar = ■ dimes
I 1 half dollar = ■ dimes
J 1 dollar = ■ quarters
K 1 quarter = ■ cents
L 1 dollar = ■ nickels
M 1 half dollar = ■ nickels
N 1 dollar = ■ cents
1
2
10 20 25 25¢ A
25 35 45 50 50¢ B
C
50¢ 25 25 D
A 25¢ = 4 nickels ■ pennies
B $1 = ■ half dollar ■ dimes
C 50¢ = 2 dimes ■ nickels
D 3 nickels 10 pennies = ■¢
E 4 dimes 10 pennies = ■¢
F 1 quarter = 2 nickels ■ pennies
G 1 half dollar = 1 quarter ■ pennies
H $1 = 3 quarters ■ nickels
I 1 dime 1 nickel 10 pennies = ■¢
J $1 = 2 quarters ■ nickels
K 3 dimes 3 nickels 5 pennies = ■¢
L $1 = 2 quarters ■ pennies
M 1 half dollar = 2 dimes ■ pennies
N 10¢ = ■ nickel ■ pennies
O 2 dimes 5 nickels 5 pennies = ■¢
P 50¢ = 1 quarter ■ nickels
Q 1 dollar = 7 dimes ■ nickels
R 25¢ = ■ dime 3 nickels
3
71

71

1 Treat Exercises A to N as matching exercises with the pictures on page 70. Let pupils take turns reading these lines aloud, saying the missing quantities. After each reading, ask the class to find a picture on page 70 that illustrates the statement that has just been read.

2 Pictures A to G provide a review of counting procedures. Pupils should study Pictures A and B before being asked to count aloud the money in Pictures C to G. Explain that overlapped nickels are to be counted as one value, and discuss convenient ways of grouping coins for counting, such as putting all coins that are alike together, or grouping together enough coins of small denominations to make a value equal to the coin next larger in value.

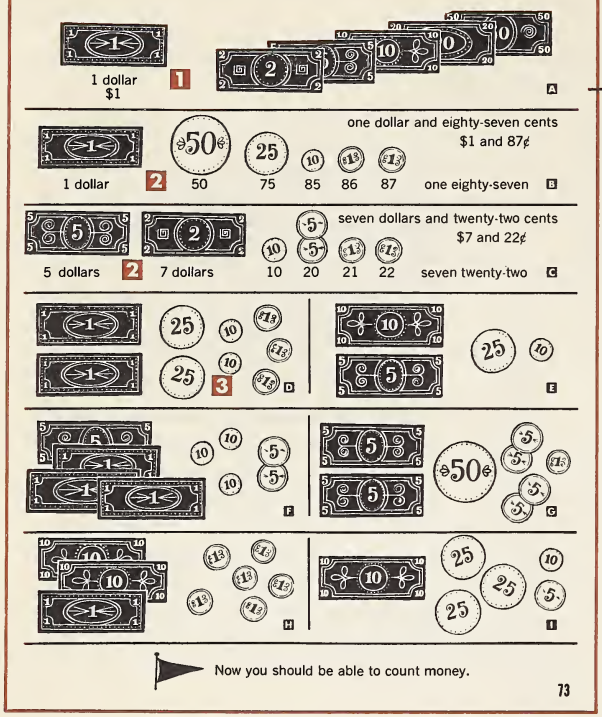
3 Let pupils take turns reading these exercises aloud, saying the missing quantities. When a child has difficulty, let him get the answer with coins or toy money or by drawing circles on the board to represent the coins.



72

1 The pupils should study Pictures A and B in detail before proceeding to Pictures C to S. They should practice counting the money by saying the cumulative number under each coin. They need not say "cents" until the entire amount has been counted. Explain that it is customary to begin counting money with the coin or bill of largest denomination and to proceed to the next smaller coin or bill until the pennies are reached.

2 Let pupils read Exercises C to S in turn, saying the amounts as they learned to do in Pictures A and B. Make sure that overlapped pennies and nickels are counted as one unit. Picture L might be read in two ways: 10, 20, 25, 27, 29, or 10, 20, 25, 29 (considering the two groups of overlapped pennies as a group of 4). Then ask each child to copy the identifying letters C to S in a column and write opposite each the numbers he would say in counting the money.



73

1 Picture A shows all the paper denominations in common use from one to fifty dollars. Since only stylized money is pictured, the teacher should show the class a few real bills and discuss how they differ in appearance. Note especially the portraits on the bills.

2 Let the class study the method of counting used in Pictures B and C. Show how money is organized for counting (larger denominations before smaller, similar denominations together). Explain that it is usual not to say "cents" until the last coin has been counted. In Picture C, make sure the pupils understand that the 2 nickels are to be counted as 10 rather than as 5 and 5. Relate the expression "one eighty-seven" to the bills and coins and to "$1 and 87¢."

3 Let pupils take turns counting the money aloud. Then have each child write the numbers he would say in counting each amount of money.

74-75 Looking back

Exponded Notes for this lesson are on pages 267-269.

Objectives

The child reviews writing amounts of money using the cent sign, the dollar sign, and the point.

Vocabulary

There are no new words.

Comments

In this lesson the child reviews what he learned in Grade 3 about writing amounts of money. The pictures again show stylized coins and bills with numerals indicating their denominations. These stylized coins and bills make a large amount of practice possible and prevent the confusion that results from children's inability to distinguish among realistic pictures of various coins and bills. However, be sure to give the children experiences with real money on occasion, so that they become familiar with the sound, feel, and appearance of the coins.

Pupils should already be aware of the fact that paper money exists in denominations of $1, $2, $5, $10, $20, and $50. They should also be familiar with the various coins and the methods commonly used in counting them. If, in reteaching this work, you find that some children are still having difficulty, give them help in reviewing the preceding lesson and a great deal of practice in counting real or toy money.

In teaching children how to read amounts of money written with the dollar sign and point, be careful to stress the fact that the word *and* is used for the point. The use of *and* in reading numbers should be avoided. For example, the number 110 should be read as "one hundred ten," not as "one hundred *and* ten." The word *and* should be strictly reserved for reading the point used to indicate cents or decimal fractions and for reading fractions. The following are examples of proper usage: "five dollars *and* thirty cents" ($5.30); "five *and* three tenths" (5.3); "five and three fifths" ($5\frac{3}{5}$). Reading $5.30 as "5 thirty" and "$5 thirty" is permissible.

The children should be familiar with two ways of writing amounts of money of less than one dollar. They should be perfectly at ease with either method. It is important to remember, however, that when they come to addition and subtraction with money, the children should be required to write the amounts with dollar signs and points. This is especially necessary in addition, because it is often difficult to anticipate whether or not the sum will exceed one dollar. Special emphasis should be given to the writing of amounts of less than ten cents with dollar signs and points, making sure the children understand that they must always put the zero at the left of the significant numeral.

Answers

Page 74:

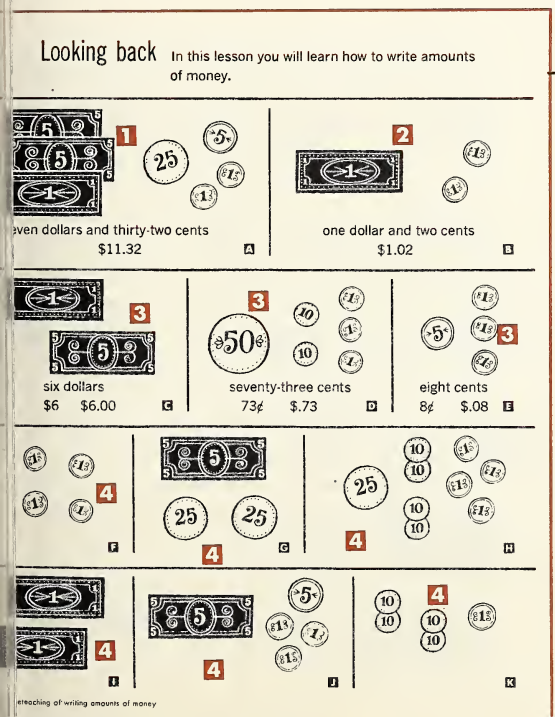
F $.04 or 4¢
G $5.50
H $.69 or 69¢
I $2.00 or $2
J $5.08
K $.41 or 41¢

Page 75 (pictures):

L $3.00 or $3
M $.43 or 43¢
N $20.45
O $1.09
P $.80 or 80¢
Q $10.03

(block 1)

A $19.05
B $28.50
C $10.18
D $.64 or 64¢
E $1.30
F $20.00 or $20
G $.01 or 1¢
H $74.13
I $2.05
J $4.07
K $.78 or 78¢
L $20.10
M $1.16
N $.90 or 90¢
O $15.24
P $.06 or 6¢
Q $55.75
R $3.40



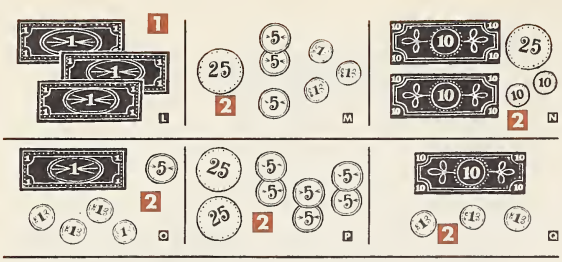
74

1 Let the children count the money in this picture. Remind them to start with the largest denomination. Call on a pupil to count the money aloud as "five, ten, eleven dollars; twenty-five, thirty, thirty-one, thirty-two; eleven thirty-two; eleven dollars and thirty-two cents." Have the pupils look at the "$11.32" at the bottom of the picture. Explain that it is read in exactly the same way as the statement above it—"eleven dollars and thirty-two cents."

2 Proceed in the same way with this picture.

3 Have the children count the money in this picture and then write the amount on paper, using numerals and signs. Remind them that amounts of less than one dollar and of dollars with no extra cents may be written in two ways. If you wish, you may require them to write the amount in both ways.

4 Follow the same procedure for this picture.



Write with numerals and signs.		Read.		
A	nineteen dollars and five cents	A	$16.80	A $45.20
B	twenty-eight dollars and fifty cents	B	$.37	B $138.06
C	ten dollars and eighteen cents	C	$.04	C $12.19
D	sixty-four cents	D	$30.00	D $.86
E	one hundred thirty cents	E	$75.55	E $3.65
F	twenty dollars	F	$.89	F $98.99
G	one cent	G	$89	G $.07
H	seventy-four dollars and thirteen cents	H	$26.47	H $340
I	two hundred five cents	I	$19.95	I $18.50
J	four dollars and seven cents	J	$7.16	J $56
K	seventy-eight cents	K	$40.08	K $.56
L	twenty dollars and ten cents	L	$100	L $7.27
M	one hundred sixteen cents	M	$.15	M $85.05
N	ninety cents	N	$.60	N $90
O	fifteen dollars and twenty-four cents	O	$620	O $.17
P	six cents	P	$.40	P $17
Q	fifty-five dollars and seventy-five cents	Q	$115.03	Q $285.56
R	three hundred forty cents	R	$20.00	R $.77

Now you should be able to write amounts of money.

75

75

1. Tell the children to count the money in this picture and then write the amount on paper, using numerals and signs. Remind them that some amounts may be written in two ways. Require them to write the amounts in both ways, if you wish.
2. Proceed in the same way with this picture.
3. Have the children write the letters A to R on their papers and write the amounts of money, using numerals and signs, opposite the letters. You may ask them to write amounts of less than one dollar and of exact dollars in two ways.
4. Let the children take turns reading these amounts aloud.

76-78 Looking back

Expanded Notes for this lessan are on pages 269-270.

Objective

The child relearns how to count and make change.

Vocabulary

New words page 78 kit, buggy*, Jane*, roundhouse*, engine*

Comments

In learning how to make change the children use what they have learned about counting coins and bills. Since the actual making of change involves the handling of money and making verbal statements about the amounts given, children should have many opportunities to work with either real money or toy money. Directions for making the toy money will be found in the Expanded Notes on page 248.

The child should learn correct procedures in making change. He must learn to select the coins and bills in a systematic manner and to count properly. It will require much experience to enable the child to have confidence in making change.

Be sure the child learns to begin counting with the price of the article sold or purchased, and to select first the coins that will bring the money counted up to a convenient amount. Convenient amounts are those equal to a nickel, dime, quarter, half dollar, or dollar.

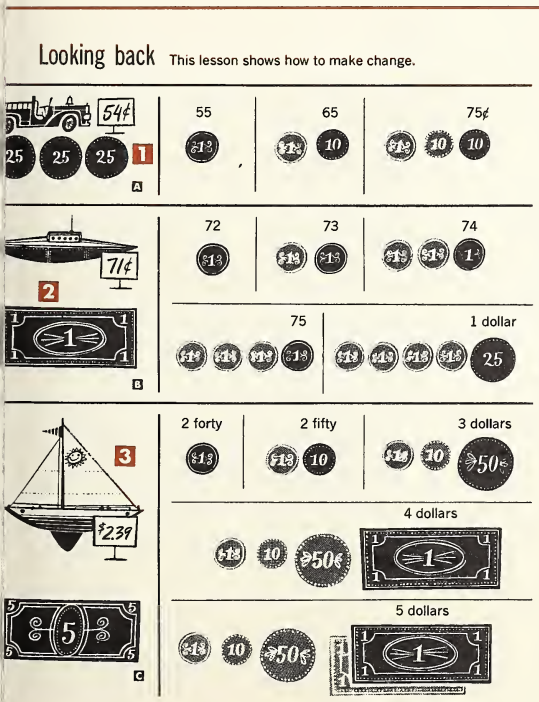
On page 76 the coins and bills in each of the pictures are arranged to show the progression of counting as additional money is given. Coins or bills previously counted are dimmed off in each row. The numeral above each new coin or bill shows what is said as it is given in change. Each picture strip shows the price of the toy sold, the amount of money offered in payment, and the coins given in change. Be sure the child knows that the rows are really progressive views of what takes place. The work on this page shows the child how to count money by procedures used in everyday life. In Picture A, for example, the child learns to say the cumulative numbers without saying "cents" until the entire

amount is counted. On page 77 the successive rows of coins and bills are omitted, and the child must figure out for himself what number is said as each piece of change is counted out.

Page 78 presents descriptions of situations requiring the making of change. For each situation the child must decide for himself what coins or bills should be given in change and what verbal statement should accompany the putting down of each coin or bill. Care should be taken to get the children to realize that in most situations change can be made in a variety of ways.

Answers

Answers are not given because there is a variety of ways of making change in each situation. Any correct way should be accepted.



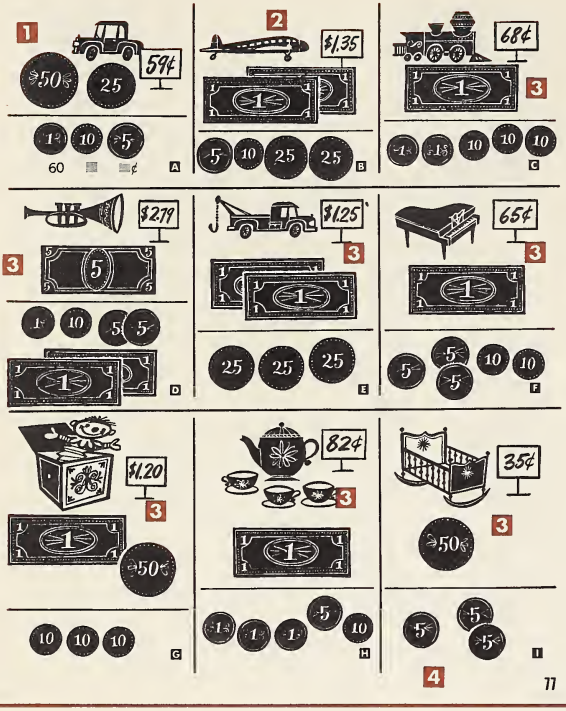
Reteaching of making change

76

1 Have pupils look at the first scene of Movie A. Explain that the sign shows how much the toy fire truck costs and the three quarters show how much the boy who bought it gave the clerk. Have them count this amount. Explain that the next three scenes show the coins that the clerk gave the boy in change and what he said as he gave him each coin. Tell the children to count the change, beginning with the cost of the truck. Explain why the clerk says "55" as he gives the penny in the first scene. Have them look at the next scene. Explain why the penny is dimmed off, and why the clerk says "65" as he gives the dime. Then explain the dimmed coins in the last scene, and why the clerk now says "75¢."

2 Proceed in the same way with this movie.

3 Proceed in the same way. Draw attention to how the clerk says dollars and cents in making change, beginning with "two forty, two fifty," and ending with "five dollars."



77

1 Explain that the part of the picture above the green line shows the toy that was bought, how much it cost, and the money given to pay for it. The coins below the green line show the change that was given. Have pupils count the coins given in change. Remind them to start with "59." Explain why "60" is said as the penny is given. Help them discover what should be said as the next two coins are given.

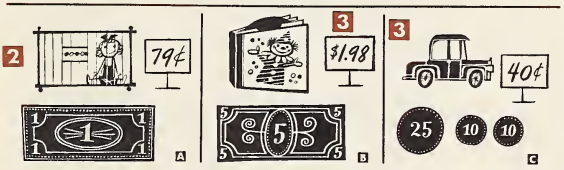
2 Tell pupils that the money illustrated above the green line shows how much was given to pay for the toy, and the coins below show how much was given in change. Have them point to the coins, saying the proper words as they do so.

3 Proceed in the same way with this picture.

4 Pupils may use this entire page as a written exercise by copying the identifying letter for each picture and writing after it numerals indicating what should be said as each coin or bill is given in change.

78

1 Draw the coins or bills that you would give in making change for each problem on this page. For each coin or bill write the number you would say as you make change.



4

D Bill gave a clerk $1 to pay for a toy car that cost 15¢.

E Mary bought a doll bed for 29¢. She gave the clerk a half dollar.

F Carol bought a 35-cent doll. She gave the clerk 2 quarters.

G Tom bought an airplane kit for 49¢. He gave the clerk a quarter and 3 dimes.

H John gave a clerk a 5-dollar bill to pay for a book that cost $1.75.

I Don gave a clerk a half dollar to pay for a puzzle that cost 31¢.

J Betty gave a clerk 6 dimes to pay for a small doll buggy that cost 52¢.

K Ann bought a game that cost $2.25. She gave the clerk a 5-dollar bill.

L Jim bought a toy airplane that cost 72¢. He gave the clerk $1.

M Jane bought a doll chair that cost 36¢. She gave the clerk a half dollar.

N Tom gave the clerk a dollar to pay for a book that cost 50¢.

O Sue gave the clerk $5 to pay for a doll that cost $4.03.

P Bill bought a roundhouse for his engine. The roundhouse cost $2.68. Bill gave the clerk $5.

Q Don bought a magnet that cost 39¢. He gave the clerk $1.

Now you should know how to make change.

78

1 Tell the children to read these directions.

2 Explain that the picture shows the toy that was bought, how much it cost, and the money given to pay for it. Tell the children to draw and label the coins that could be given in change. Have them write under each coin the number the clerk would say as he gave the coin in change. Make sure all the children understand what they are to do.

3 If all the children understand how to proceed, let them work independently on this picture.

4 Tell the children to copy the identifying letter for each problem, and after it draw the coins and bills that could be given in change. Ask them to write under each coin or bill the number that the clerk would say as he gave it in change.

79 Thinking straight; Keeping skillful

Exponded Notes ore not considered necessory for these lessons.

Objectives

The child develops resourcefulness in thinking about money and the number system. He gains insight into the meaning of the figures in a number and into the relationships among coins.

Vocabulary

New words page 79 only*, once*, tell*, name*

Comments

Anything that resembles a puzzle is interesting to children. This page can be made lively and enjoyable by presenting it as a puzzle.

Allow the children to discuss the exercises under "Thinking straight" and exchange ideas about them. Let different children give their answers and the reasons for them for each exercise. Require the children to give reasons for any statements they make. If any of the children go beyond the concepts that have been taught, accept their answers but do not discuss or develop them. If, for example, some of the children wish to make fractions of the numbers in Exercises E and G, let them do so, but do not permit the class to become involved in a discussion of fractions.

Answers

Thinking straight: A Three; 10 pennies; 5 pennies 1 nickel; 2 nickels; B 25 pennies; 20 pennies 1 nickel; 15 pennies 1 dime; 15 pennies 2 nickels; 10 pennies 1 dime 1 nickel; 10 pennies 3 nickels; 5 pennies 4 nickels; 5 pennies 2 dimes; 5 pennies 1 dime 2 nickels; 5 nickels; 2 dimes 1 nickel; 3 nickels 1 dime; C 4 pennies, a nickel, and a quarter; D 4321; E 1234; F 8520; G 2058; H Fewer; in 213 the 1 means 10 boys, and in 123 it means 100 boys.

Keeping skillful:

A 50¢	D 80¢	G 75¢	J 65¢	M 90¢
B 45¢	E 35¢	H 30¢	K 90¢	N 55¢
C 25¢	F 55¢	I 80¢	L 65¢	

Thinking straight

A How many ways can you make change for a dime? What are they? 1

B Tell six ways to make change for a quarter.

C Nancy gave a clerk a half dollar to pay for a puzzle that cost 16¢. The clerk used the smallest number of coins that he could when he gave her the change. Name the coins he gave her.

D Write the largest number you can using each of the figures 1, 2, 3, and 4. Use each figure only once. 2

E Write the smallest number you can using each of the figures 1, 2, 3, and 4. Use each figure only once.

F Write the largest number you can using each of the figures 5, 8, 0, and 2. Use each figure only once.

G Write the smallest number you can using each of the figures 5, 8, 0, and 2. Use each figure only once.

H One school has 213 boys. Another school has 123 boys. Does the 1 in 213 stand for more or fewer boys than the 1 in 123? Why? 3

Keeping skillful

4

A 4 dimes 2 nickels = ■¢
B 1 quarter 2 dimes = ■¢
C 3 nickels 10 pennies = ■¢
D 1 half dollar 3 dimes = ■¢
E 3 nickels 2 dimes = ■¢
F 2 quarters 5 pennies = ■¢
G 1 half dollar 1 quarter = ■¢
H 6 nickels = ■¢
I 8 dimes = ■¢
J 1 half dollar 3 nickels = ■¢
K 3 quarters 3 nickels = ■¢
L 5 dimes 15 pennies = ■¢
M 1 half dollar 4 dimes = ■¢
N 1 quarter 6 nickels = ■¢

5

A 35 ÷ 5 = ■
B 28 ÷ 4 = ■
C 5 × 6 = ■
D 36 ÷ 4 = ■
E 7 × 5 = ■
F 3 × 9 = ■
G 30 ÷ 6 = ■
H 32 ÷ 4 = ■
I 7 × 3 = ■
J 36 ÷ 6 = ■
K 4 × 5 = ■
L 35 ÷ 7 = ■
M 8 × 4 = ■
N 3 × 8 = ■

5

A 27 ÷ 9 = ■
B 6 × 4 = ■
C 4 × 7 = ■
D 36 ÷ 9 = ■
E 9 × 3 = ■
F 4 × 9 = ■
G 21 ÷ 7 = ■
H 27 ÷ 3 = ■
I 4 × 6 = ■
J 30 ÷ 5 = ■
K 6 × 6 = ■
L 8 × 3 = ■
M 28 ÷ 7 = ■
N 6 × 5 = ■

79

1 Exercises A, B, and C should be done orally. Let various children show or tell how they would make change. Unless lack of time makes it necessary, do not limit them to six ways to make change for a quarter, but encourage them to think of as many ways as they can.

2 Ask the children to write the answers to Exercises D to G. When they have finished writing, encourage them to discuss their answers and explain what they did.

3 This exercise should be done orally.

4 These exercises may be handled either as oral or as written work. Require the children always to write the cents' sign after the number.

5 These exercises give the children a chance to recall multiplication and division basic facts in mixed order. They may be done orally, by calling on children at random, or they may be written.

80-81 Learning how

Exponded Notes for this lesson ore on poges 270-271.

Objectives

The child learns how to add numbers that represent dollars and cents.

Vocabulary

New words page 80 junior, cross*; page 81 washing*, dishes*

Comments

It is important for the children to understand that when they add numbers that stand for dollars and cents they do it in exactly the same way that they would when they add numbers that stand for groups of dogs or cookies or oranges. The only new thing they need to learn is that the dollar sign and point must always be used. It is desirable to use the dollar sign and point in computation, for, even though the amounts added may all be less than a dollar and only the cent sign may appear in the equation, the sum may exceed 99¢. When it does, it is usually written with the dollar sign and the point. Note that this point is not called the cents' point in these lessons. It is referred to as the point so that there will be no difficulties when decimals are introduced in a later grade.

Of course you will carefully direct the work for the SEE and THINK steps. Then you should encourage children to proceed independently with the TRY and DO steps. When a child can successfully work the exercises in the TRY step, he should go on to those in the DO step.

Answers

Page 81 (block 1):

A	$2.01	F	$1.15	J	$13.59	N	$15.81
B	$1.24	G	$1.51	K	$8.95	O	$2.84
C	$1.65	H	$95.47	L	$3.10	P	$18.84
D	$48.55	I	$2.17	M	$1.37	Q	$3.11
E	$51.90						

(block 2)

A	$.98	D	$21.11	G	$15.08
B	$77.77	E	$87.95	H	$34.95
C	$.75	F	$42.45	I	$8.94

Learning how

This lesson will show you how to add dollars and cents.

see

Jim earned money for the Junior Red Cross. One week he earned 35¢. The next week he earned 41¢. The third week he earned 85¢. How much money in all did he earn?

35¢+41¢+85¢=▒ You must find this number.

```
 35
 41
 85
---
161
```

You add just as you do with any numbers.

The sum 161 means 161¢.

When you add amounts of money, you should write the amounts with points and dollar signs.

```
 $ .35
   .41
   .85
------
$1.61
```

Write the points in a line, one under the other. Write only one dollar sign.

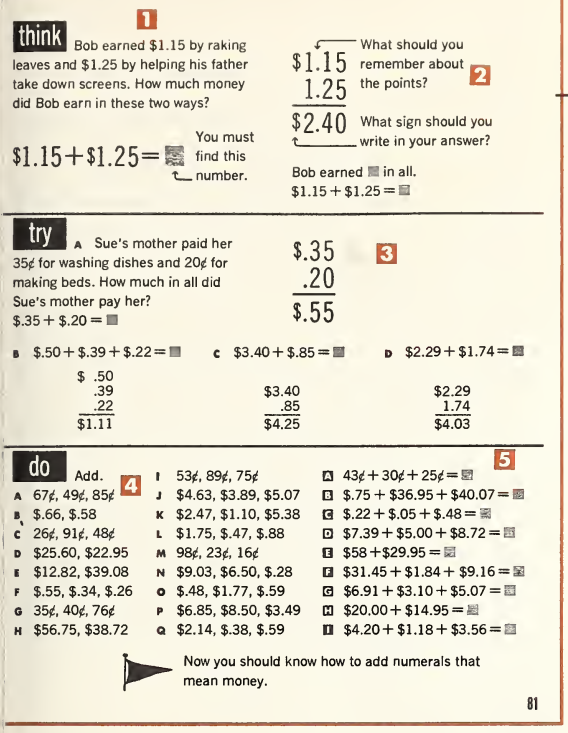
Remember to put a point and a dollar sign in the answer.

Jim earned $1.61 for the Junior Red Cross.

$.35+$.41+$.85=$1.61

80

1. Have the children count the groups of coins and note that they show the three amounts of money given in the problem and equation.
2. Draw attention to the computation. Point out that the numbers are added in the usual way. The numbers all stand for cents.
3. Point out that all the numbers here are the same as those above. Be sure pupils understand why the points and dollar signs are where they are. Tell them that when the sum is written in this way we read it "one sixty-one" or "one dollar and sixty-one cents." Discuss how inconvenient it would be to read all amounts of money as cents only.
4. Get the children to notice that these coins are arranged as one dollar, sixty cents, and one cent, and that the coins are the same as in Picture A above.
5. Relate the equation to the two pictures and the problem. Have the children check to see that it fulfills the conditions of the problem.



81

1. Ask the children to read the problem and then to check the equation to see if it describes the problem situation. They should understand that this is an additive situation in which two groups of money are being put together.
2. Have them check the computation and answer the questions. Relate the two statements at the bottom to the problem and the computation.
3. Have the children cover the computation printed in green as they do one or more of these exercises independently. Then ask them to refer to the completed computation to see if they have done their work correctly. If they understand what they are doing, they can go on to the practice work, labeled DO.
4. Have the children write these exercises (A to Q) in computational form, with the dollar sign and point, and work them. Supply answers and let the pupils verify their work.
5. Exercises A to I may be used for additional practice if it seems necessary.

82-83 Learning how

Expanded Notes for this lesson are on pages 272-273.

Objectives

The child learns how to subtract numbers that represent dollars and cents.

Vocabulary

New words page 82 always*

Comments

In general the same ideas apply to the subtraction of numbers that represent or stand for dollars and cents that applied to addition of such numbers. The children must understand that the computation is the same as it would be if the numbers stood for groups of dogs, apples, or anything else. They must form the habit of using the dollar sign and point both in the computation and in the answer.

The four-step teaching method is used to teach the subtraction of money. Be sure to discuss the SEE and THINK steps carefully with the pupils before permitting them to work independently on the TRY and DO steps. Success with the exercises in the TRY step should indicate to the pupil that he can go on to the exercises in the DO step.

Answers

Page 83 (block 1):

A	$1.84	E	$.18	I	$.63	M	$2.62	Q	$33.74
B	$.75	F	$1.44	J	$20.85	N	$.70	R	$.09
C	$.87	G	$3.24	K	$.19	O	$13.45	S	$2.35
D	$4.51	H	$.19	L	$3.80	P	$4.58		

(block 2)

A	$5.15	C	$5.55	E	$.22	G	$2.00	I	$3.44
B	$.70	D	$3.00	F	$2.25	H	$2.05	J	$8.15

Learning how

In this lesson you will learn how to subtract amounts of money.

see

A John has $2 to spend. If he buys a game for $1.35, how much money will he have left to spend?

$2.00 − $1.35 = ▢ (1) — You must find this number.

B

$$\begin{array}{r} \$2.00 \\ 1.35 \end{array}$$ (2) — When you write the numerals, be sure to keep the points one under the other.

Think of one of the dollars as made up of coins. (3)

C

Take away one dollar and thirty-five cents.

$$\begin{array}{r} \$2.00 \\ 1.35 \\ \hline \$\ .65 \end{array}$$ (4) — Subtract as you always do. Remember to put a dollar sign and a point in the answer.

D

John will have $.65 left to spend. (5)

$2.00 − $1.35 = $.65 (6)

82 Reteaching of subtraction of money

think

Mary had $3.48 in her savings bank. She took out $.79 to buy some paper dolls. How much money was left in her bank?

$3.48 − $.79 = ▢ (1) — You must find this number.

$$\begin{array}{r} \$3.48 \\ .79 \\ \hline \$2.69 \end{array}$$ (2) — What should you remember about the points? What sign should you write in the answer?

There was ▢ left in Mary's bank. $3.48 − $.79 = ▢

try

A Jim had 42¢ when he went to school one day. He spent 34¢ for his lunch. How much money did he have then? (3)

$.42 − $.34 = ▢

$$\begin{array}{r} \$.42 \\ .34 \\ \hline \$.08 \end{array}$$

B $3.00 − $1.28 = ▢

$$\begin{array}{r} \$3.00 \\ 1.28 \\ \hline \$1.72 \end{array}$$

C $7.14 − $6.29 = ▢

$$\begin{array}{r} \$7.14 \\ 6.29 \\ \hline \$\ .85 \end{array}$$

D $19.62 − $17.69 = ▢

$$\begin{array}{r} \$19.62 \\ 17.69 \\ \hline \$\ 1.93 \end{array}$$

do

Subtract. (4)

A $1.82 from $3.66
B 17¢ from 92¢
C $.38 from $1.25
D $3.49 from $8.00
E 72¢ from 90¢
F $.89 from $2.33
G $6.76 from $10.00
H 55¢ from 74¢
I $.08 from $.71
J $29.50 − $8.65 = ▢
K $.88 − $.69 = ▢
L $6.75 − $2.95 = ▢
M $7.00 − $4.38 = ▢
N $2.05 − $1.35 = ▢
O $18.30 − $4.85 = ▢
P $6.00 − $1.42 = ▢
Q $39.64 − $5.90 = ▢
R $.92 − $.83 = ▢
S $5.00 − $2.65 = ▢
A $8.15 − $3.00 = ▢ (5)
B $5.05 − $4.35 = ▢
C $6.98 − $1.43 = ▢
D $8.95 − $5.95 = ▢
E $.78 − $.56 = ▢
F $9.50 − $7.25 = ▢
G $4.15 − $2.15 = ▢
H $9.00 − $6.95 = ▢
I $6.70 − $3.26 = ▢
J $9.00 − $.85 = ▢

Now you should be able to subtract amounts of money.

83

84

82

1 Call attention to the equation. Have the children check to see that it correctly states the problem in symbols. Refer to Picture A.

2 Point out that the computational form is the same as for any subtraction problem. Be sure the children know why the points are placed where they are.

3 Have them count the money in Picture B to be sure that it is equivalent to the money in Picture A. Ask what has happened to one of the bills.

4 Have them count the money that is being taken away in Picture C and relate it to the computation at the right. Have them check the computation at the right. Ask why there is no figure in the dollars' place in the answer. Ask someone to read the answer. Explain why the dollar sign and point are used in the answer.

5 Have them relate the coins in Picture D to the answer.

6 Refer back to the problem.

83

1 Ask the children to read the equation to see if it puts into symbols the idea of the problem.

2 Have them go over the computation and answer the questions. Relate the two statements at the bottom to the problem and the computation.

3 Have the children cover the computation printed in green, do one or more of these examples independently, and then compare with the computation in the book to see if they have done their work correctly. If they understand what they are doing, they can go on to the practice work that follows.

4 Have the children write these exercises in computational form, with the dollar sign and point, and work them. Supply answers and let the pupils verify their work.

5 These exercises can be used for additional practice if it seems necessary.

84 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving addition and subtraction problems involving money.

Vocabulary

New words page 84 combs, toothbrushes*, toothpaste, notebooks

Comments

Note that the amounts of money in these problems are written in various ways. In some, amounts of less than one dollar are written with the dollar sign and point, and in others the cents' sign is used. Remind the children that when they compute they should always use the dollar sign and point. The equation may be written with the cents' sign if the children wish, because it may be easier for some of them to write the numbers in the form in which they are given in the problem. They should, however, change to the dollar sign and point when they write the numbers in computational form.

Answers

All numbers may be written with the dollar sign and point instead of with the cents' sign.

A $.85+$1.38=[$2.23] or $1.38+$.85=[$2.23]
B 50¢−23¢=[27¢]
C $4.05−$.75=[$3.30]
D 89¢+35¢=[$1.24] or 35¢+89¢=[$1.24]
E 15¢+25¢+98¢=[$1.38]
F $6.24−$2.53=[$3.71]
G 15¢+30¢=[45¢] or 30¢+15¢=[45¢]
H $4.21−$2.25=[$1.96]
I 25¢+10¢+15¢=[50¢]
J 35¢+25¢=[60¢] or 25¢+35¢=[60¢]

Using arithmetic 1

A The fourth graders bought things to put in Junior Red Cross boxes. They spent $.85 at one store and $1.38 at another store. How much money did they spend at both stores?

B Bill had 50¢. He spent 23¢ for soap and the rest for combs. How much did he spend for combs?

C The children spent $4.05 at one store. They spent $.75 for notebooks and the rest for small toys. How much did they spend for small toys?

D The box of toothbrushes Tom wanted to buy cost 89¢. The toothpaste he wanted cost 35¢. How much money did he need for these two things?

E Nancy spent 15¢ for pencils, 25¢ for tablets, and 98¢ for crayons. How much did she spend altogether for these three things?

F Together, the fourth and fifth grades spent $6.24 for games to put in the Junior Red Cross boxes. The fourth grade spent $2.53. How much did the fifth grade spend?

G Ann spent 15¢ for a paintbrush and 30¢ for a paint box. She spent how much in all?

H The fourth graders spent $4.21 for toothbrushes and toothpaste. They spent $2.25 for toothbrushes and the rest for toothpaste. How much did they spend for toothpaste?

I Don spent 25¢ for a whistle, 10¢ for a top, and 15¢ for a ball. He spent how much altogether?

J Sue spent 35¢ for paste and 25¢ for colored pencils. How much money did she spend for these things? 2

Checking up

Test 1

A $.64+$.32=▩
B Add 17¢, 53¢, and 76¢.
C Add $.83, $.50, and $.67.
D $6.41+$2.75=▩
E $3.20+$3.81+$1.64=▩
F $9.05+$7.28+$4.56=▩
G 87¢+59¢+35¢=▩

Test 2

A $.87−$.63=▩
B $.62−$.57=▩
C Subtract $4.86 from $7.75.
D $1.29−$.74=▩
E Subtract $5.25 from $9.03.
F $14.70−$6.28=▩
G $15.00−$6.47=▩

4 End-of-block tests on addition and subtraction of money

84

1 Have the children work these problems independently. They should read the problem, make an equation with a screen (or square) to represent the unknown number, rewrite the numbers in computational form and compute, and finally write the equation again with the answer. Be sure they remember to use the dollar sign and the point in the computation.

2 Check to see which of these problems caused difficulty and discuss them with the class as a whole. Problems that only a few children found difficult can be discussed individually with those pupils.

84 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his skill in addition and subtraction involving numbers that represent money.

Vocabulary

There are no new words.

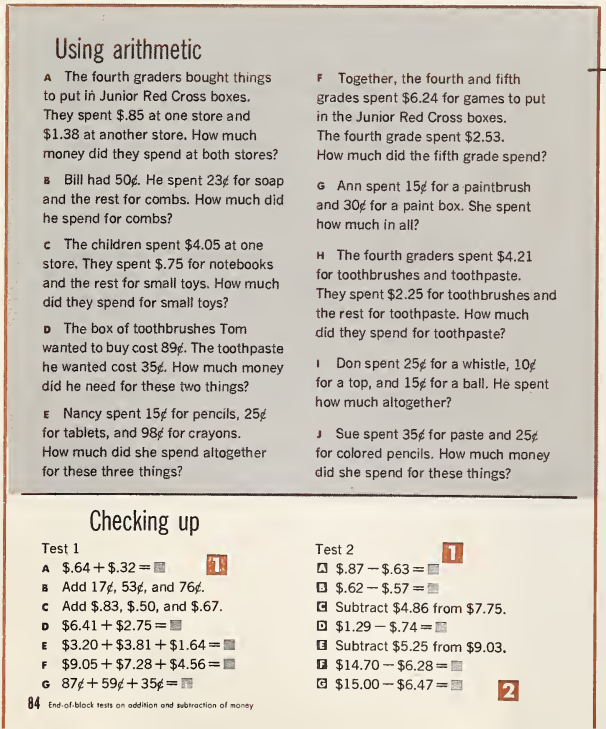
Comments

These tests can be used diagnostically to find out how well the children can write numbers with the dollar sign and point for computing, and how well they can add and subtract such numbers. Direct the children to use the point and dollar sign in writing the numbers for computation.

For those children who show weakness in the addition of numbers that represent dollars and cents, review the work presented on pages 80 and 81. For those who show weakness in the subtraction of numbers that represent dollars and cents, review the work on pages 82 and 83. It is always a good plan to examine carefully, after a test has been given, the work of those children who missed several examples. Such examination will reveal the kind of errors the children have made and will assist you in specific reteaching that will help prevent the recurrence of such errors.

Answers

Test 1		Test 2	
A $.96	E $8.65	A $.24	E $3.78
B $1.46	F $20.89	B $.05	F $8.42
C $2.00	G $1.81	C $2.89	G $8.53
D $9.16		D $.55	



Using arithmetic

A The fourth graders bought things to put in Junior Red Cross boxes. They spent $.85 at one store and $1.38 at another store. How much money did they spend at both stores?

B Bill had 50¢. He spent 23¢ for soap and the rest for combs. How much did he spend for combs?

C The children spent $4.05 at one store. They spent $.75 for notebooks and the rest for small toys. How much did they spend for small toys?

D The box of toothbrushes Tom wanted to buy cost 89¢. The toothpaste he wanted cost 35¢. How much money did he need for these two things?

E Nancy spent 15¢ for pencils, 25¢ for tablets, and 98¢ for crayons. How much did she spend altogether for these three things?

F Together, the fourth and fifth grades spent $6.24 for games to put in the Junior Red Cross boxes. The fourth grade spent $2.53. How much did the fifth grade spend?

G Ann spent 15¢ for a paintbrush and 30¢ for a paint box. She spent how much in all?

H The fourth graders spent $4.21 for toothbrushes and toothpaste. They spent $2.25 for toothbrushes and the rest for toothpaste. How much did they spend for toothpaste?

I Don spent 25¢ for a whistle, 10¢ for a top, and 15¢ for a ball. He spent how much altogether?

J Sue spent 35¢ for paste and 25¢ for colored pencils. How much money did she spend for these things?

Checking up

Test 1

A $.64 + $.32 = ▩ 1

B Add 17¢, 53¢, and 76¢.

C Add $.83, $.50, and $.67.

D $6.41 + $2.75 = ▩

E $3.20 + $3.81 + $1.64 = ▩

F $9.05 + $7.28 + $4.56 = ▩

G 87¢ + 59¢ + 35¢ = ▩

Test 2

A $.87 − $.63 = ▩ 1

B $.62 − $.57 = ▩

C Subtract $4.86 from $7.75.

D $1.29 − $.74 = ▩

E Subtract $5.25 from $9.03.

F $14.70 − $6.28 = ▩

G $15.00 − $6.47 = ▩ 2

84 End-of-block tests on addition and subtraction of money

84

1 The children should work these exercises independently. Have them rewrite each exercise in computational form and compute. Insist that they use the dollar sign and point.

2 Check to see which of the exercises caused difficulty and discuss them with the class. Exercises that only a few children had difficulty with can be discussed with them individually at another time. If any general reteaching is necessary, do it now.

85 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child reviews what he has learned about reading thermometers and about the number system, tests his knowledge of multiplication and division basic facts, and tests his ability to compute in addition and subtraction.

Vocabulary

There are no new words.

Comments

This lesson provides an opportunity for reviewing what was learned previously about reading thermometers and reading and understanding place value in four-figure numbers. It also provides practice in division and multiplication basic facts and in addition and subtraction computation to enable the children to maintain those skills or to reveal any weaknesses in them. The first three sets of exercises may be done orally first to determine whether or not any reteaching of reading temperatures or the number system is necessary and to be sure that the children can respond quickly and accurately with division and multiplication basic facts.

Answers

(block 1)

A 234° B 20° C 42° D Thermometer B
E Thermometer A

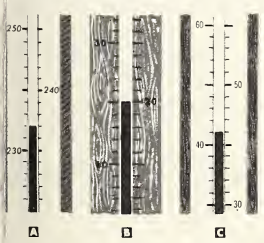
(block 3)

A 4	C 0	E 9	G 2	I 8
B 5	D 8	F 1	H 0	J 3

(block 4)

A 454	F 145	K 238	P 286
B 100	G 3961	L 154	Q 169
C 973	H 1411	M 1761	R 656
D 347	I 1066	N 610	
E 715	J 229	O 360	

Keeping skillful



1

A What temperature is shown on Thermometer A?

B What temperature is shown on Thermometer B?

C What temperature is shown on Thermometer C?

D Which thermometer shows a temperature that is below the freezing point of water?

E Which thermometer shows a temperature that is above the boiling point of water?

2

A 8×3=	G 6×6=	M 24÷6=	S 5×7=
B 16÷2=	H 32÷8=	N 18÷9=	T 36÷6=
C 28÷7=	I 3×9=	O 5×4=	U 4×8=
D 3×6=	J 18÷3=	P 36÷4=	V 6×4=
E 35÷5=	K 5×5=	Q 6×5=	W 24÷8=
F 7×4=	L 9×4=	R 3×7=	X 30÷5=

3

A In 7042, ▩ is in tens' place.
B In 516, ▩ is in hundreds' place.
C In 3290, ▩ is in ones' place.
D In 8652, ▩ is in thousands' place.
E In 4709, ▩ is in ones' place.
F In 6315, ▩ is in tens' place.
G In 2648, ▩ is in thousands' place.
H In 1503, ▩ is in tens' place.
I In 5821, ▩ is in hundreds' place.
J In 3679, ▩ is in thousands' place.

4

A 875−421=	G 1576+2385=	M 732+460+569=
B 34+29+37=	H 402+681+328=	N 1547−937=
C 525+448=	I 1634−568=	O 235+80+45=
D 473−126=	J 508−279=	P 800−514=
E 1940−1225=	K 86+95+57=	Q 406−237=
F 92+15+38=	L 703−549=	R 382+98+176=

.85

85

1 Have the children respond orally to these questions. Also ask such questions as: "What do the numerals on the thermometers stand for? What number should be opposite the first mark above 40? The second? The third?" Encourage the children to respond as fully as they can.

2 First do these exercises orally. Work for promptness of response as well as accuracy. They may also be used for written work.

3 First do these exercises orally. Ask the children to read each statement aloud to review their ability to read four-figure numbers. The exercises may also be used for written work. Direct them to write only the numbers for the screens.

4 Have the children write the exercises in computational form and do the computation. Supply a set of answers and have them correct any mistakes they may have made.

86-87 Exploring problems

Expanded Notes for this lesson ore on pages 274-276.

Objectives

The child learns to solve problems in which he must compare two quantities by finding either how many more objects there are in one group than in another group or how many fewer objects there are in one group than in another.

Vocabulary

New words page 86 lollipops; page 87 model*, whether*

Comments

So far in this grade, the child has been taught only one type of subtractive situation: that in which part of a group is removed and he is to find the size of the remaining group. In such situations there is only one group of objects, and the remaining group is part of the original group. Now the child is going to work with situations in which there are two separate groups of objects, not necessarily of the same kind. He is to find out how many more or how many fewer objects there are in one group than in the other.

In this new type of situation there is no real taking away of anything; so there is no real subtractive action. But since the process of subtraction is used to solve the situation, the child should learn why he can subtract. This means that in some way the situation must be viewed as a subtractive one.

Actually, in solving this type of problem, the activity that would be used with objects is that of matching each object in one group with an object in the other group to find out how many objects cannot be matched. The child should learn to think of those objects in the larger group that have been matched with objects in the smaller group as being removed, or put aside, so that the number of the remaining objects can be determined. When he subtracts in this type of situation, it amounts to removing the same number of objects from the larger group as there are objects in the smaller group. Then the objects remaining in the larger group tell him both how much larger that group is than the other group, and also how many fewer objects the smaller group has than the other group. You may find it helpful to have the children use objects to duplicate the action of the problems.

In this lesson both the "See" step and the "Compute" step are shown. In the "See" step the child makes the equation and sees why he can say "45−32=▒." In the "Compute" step he is interested only in doing the computation that will tell him what the missing number is.

In Problem A on page 87, a diagrammatic device is used to explain the numbers in the equation. This device is used many times throughout the book, and it should be fully discussed at this time. The children should be able to explain some of the equations they make in this way.

Keep in mind that the word *fewer* is the correct term to use when comparing the number of items in two different groups. The word *less* is used to compare the bulk or amount of two different quantities. For example, we would say *fewer* lumps of sugar but *less* sugar, or *fewer* pennies but *less* money. Do not attempt to have the children observe this distinction, but take care to use these terms correctly in your own directions and explanations. The difficulty does not arise with the word *more* because it applies to both situations.

Answers

Page 87:

A 31−17=[14]
B 31−17=[14]
C 140−115=[25]
D $10.30−$7.45=[$2.85]
E 21−12=[9]
F $2.35−$.90=[$1.45]
G $.70−$.25=[$.45]
H $1.35−$.50=[$.85]
I 23−16=[7]
J $.75−$.69=[$.06]
K $.20+$.55=[$.75] or $.55+$.20=[$.75]
L $1.05−$.69=[$.36]

Exploring problems

see

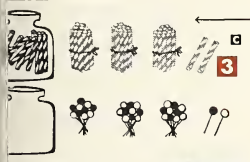
A

At a school sale, the girls sold 45 candy sticks and 32 lollipops. They sold how many more candy sticks than lollipops? They sold how many fewer lollipops than candy sticks? 1

B 2

Match as many candy sticks as you can with lollipops. 32 candy sticks can be matched with lollipops.

Some of the 45 candy sticks are not matched. You must find how many of the 45 candy sticks are not matched.



C 3

Imagine that the 32 matched candy sticks are gone.

$45-32=\square$ 4

This shows that you imagine 32 of the 45 as gone.

You must find this number.

compute

$$\begin{array}{r} 45 \\ 32 \\ \hline 13 \end{array}$$ 5

Subtract to find the missing number. This number means that there are 13 more candy sticks than lollipops.

$45-32=\square$ 6

The girls sold 13 more candy sticks than lollipops.
They sold 13 fewer lollipops than candy sticks.

1 Reteaching of finding how many more than or how many fewer than

A At the school sale Nancy sold 17 dolls and 31 doll dresses. She sold how many more doll dresses than dolls? 1

Number of doll dresses.

Number of dresses matched with dolls. Imagine these as gone.

Number of dresses not matched with dolls.

$31-17=\square$

You must find this number.

Subtract 17 from 31.
Nancy sold ☐ more dresses than dolls.

B Nancy sold how many fewer dolls than doll dresses? 2

C Don sold 115 stamps from his collection. Jack sold 140 stamps from his collection. Don sold how many fewer stamps than Jack? 3
$140-115=\square$

D Ann collected $7.45 at the candy table. At the book table Peggy collected $10.30. Ann collected how much less money at her table than Peggy collected at hers? 3
$\$10.30-\$7.45=\square$

E Ann sold 12 bags of nuts and 21 bags of chocolate candy. She sold how many more bags of chocolate candy than of nuts? 4

F Mrs. Brown spent $2.35 for books and $.90 for candy. How much more did she spend for books than for candy?

G Jim had 70¢ to spend at the sale. First he bought 25¢ worth of stamps from Don. Then Jim had how much money?

H A doll dress Sue wanted cost 50¢. A doll she wanted cost $1.35. The doll dress cost how much less than the doll?

I At the toy table Bill sold 16 model airplanes and 23 model cars. He sold how many more cars than airplanes?

J Bob did not know whether to buy a model airplane for 69¢ or a model car for 75¢. The model airplane cost how much less than the model car?

K Dick wanted to buy a bag of candy that cost 20¢ and a model car that cost 55¢. How much money did he need to buy these two things?

L Tom had $1.05 to spend. He bought a book about horses for 69¢. How much money did he have left? 5

Now you should know how to find how much larger or smaller one amount or group is than another amount or group.

86

1. Have the children read the problem and relate the numbers in it to the picture.
2. Be sure the children observe that all the lollipops (the smaller group) have been taken out of the jar and that the same number of candy sticks has been taken out. Discuss the statement that they must find out how many are not matched.
3. Draw attention to the dimming off in the picture. Be sure pupils understand that this means they are to think of these candy sticks as being taken away from the total number of candy sticks, and the number of candy sticks dimmed off is the same as the number of lollipops.
4. Discuss the equation. 45 is the original number of candy sticks; 32 is the number matched with lollipops and taken away. The screen indicates the number of candy sticks left in the jar.
5. Have pupils verify the subtraction.
6. Have pupils complete this equation, then have them apply it to the questions in the problem.

87

1. Relate the problem to the equation and discuss each statement in the diagram. Pupils should use the computational form to find the missing number.
2. Make clear that there are just as many fewer dolls than dresses as there are more dresses than dolls. Help pupils see that the same equation stands for both situations.
3. Work through this problem with the children. Have them explain what each number in the equation means. Then have them compute.
4. Have them work Problems E to L independently. Direct them to write each equation with the screen, or square, do the computation, then rewrite the equation with the answer. All the *computation* involving money should be written with the dollar sign and point. Warn them that some of the problems (G, K, L) are not like A to D.
5. Supply answers for the children to verify their work, and discuss the problems with them.

88-90 Exploring problems

Expanded Notes for this lessan are an pages 276-278.

Objectives

The child learns how to solve problems in which he must find how many were added or how many more are needed.

Vocabulary

New words page 89 family*; page 90 china, present*, old*

Comments

The type of problem in which the child is to find how many more are needed has always been a difficult one. However, it is important to keep in mind that this kind of problem is a special case of a more general type including problems in which children must find how many were added to a known group. Both kinds of problems are included in this lesson. The lesson begins with the more general kind in which the child must find how many were added.

The difficulty the child has in solving problems of this kind arises from his inability to reconcile the problem situation to the computational process that must be used to find the answer. He has learned from previous experience that the action in these problems—the joining of one group with another to form a larger group—is characteristic of an additive situation. However, he may be confused by the fact that, to find the unknown quantity, he must subtract. The aim of this lesson is to make clear to him why subtraction will provide the answer to this kind of additive problem.

This lesson includes two parts. In the "See" part the child learns how to build the proper equation for a problem of this type. The "Compute" step shows him why subtraction is used to find the answer. The pictures are designed to help the child grasp the ideas involved. However, you will find it helpful, and perhaps necessary, to have the children use objects to duplicate the illustrated actions. This will help you diagnose and clear up any thinking difficulties that may arise.

The importance of the equation in problem solving becomes evident with problems of this kind. The equation the child learns to make in the "See" step shows the problem situation very clearly. He is permitted to think of the situation as an additive one, and he feels comfortable about it. Then, in the "Compute" step, he confines his attention strictly to finding the missing number.

Answers

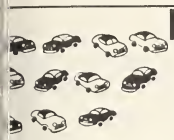
Pages 89-90:

The brackets represent the screen in the equation; the numerals within them, the answer.

A $16+[9]=25$
B $48+[22]=70$
C $\$.78+[\$.47]=\$1.25$
D $23+[8]=31$
E $17+[9]=26$
F $43+[25]=68$
G $37+[15]=52$
H $\$1.91-\$1.72=[\$.19]$
I $51-27=[24]$
J $\$2.35-\$.98=[\$1.37]$
K $\$.35+[\$.95]=\$1.30$
L $\$9.42+[\$5.58]=\$15.00$
M $17+[13]=30$
N $\$.59+[\$.16]=\$.75$
O $\$.89+[\$.61]=\$1.50$
P $18+[8]=26$
Q $\$.48+[\$.37]=\$.85$
R $\$.88+[\$.37]=\$1.25$

Exploring problems

see



A Bill had 11 model cars. He bought some more cars at the toy store. Then he had 14 model cars. How many model cars did he buy at the toy store? 1

Bill had 11 model cars at first.

11 ← Number of cars Bill had at first

B You do not know how many more cars Bill bought.

$11+\square$ ← Number of cars he bought 2 3

Bill has 14 model cars now.

C $11+\square=14$ ← Number of cars he has now 4 5

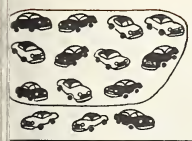
You must find this number.

compute

You know Bill has 14 model cars now.

D 6 14 ← Number of cars he has now

Reteaching of finding how many were added or how many more are needed



E Think of a group of cars equal to the cars Bill had at first. 1

11 ← Number of cars Bill had at first

F Imagine that this group of 11 cars is gone. 2

14
11 ← Subtract 11 from 14.
$\square$

14
11 3 The number that is left shows how many cars Bill bought at the toy store.
3 ← Bill bought 3 cars.

4 $11+\square=14$ ← This number is 3. Bill bought 3 cars.

Ann wanted to buy a 25-cent book. She had 16¢. How much more money did she need to buy the book? 5

Number of cents Ann had.
Number of cents Ann must add to the money she had.
Number of cents she needed in all.
$16+\square=25$ ← You must find this number.
Subtract 16 from 25.
Ann needed $\square$ more cents.

B Bill had 48 stamps. After he bought some new stamps, he had 70 stamps. How many new stamps did he buy? 5

$48+\square=70$
Subtract 48 from 70.

C Ellen wanted to buy a family of dolls for her dollhouse. The set of dolls cost $1.25. Ellen had 78¢. How much more money did she need to buy the doll family? 5

$\$.78+\square=\$1.25$
Subtract $.78 from $1.25.

88

1 Tell the children to read the problem and look at Picture A. Make sure they understand that the picture shows the 11 cars Bill had at first. Point out that the green numeral 11 is the start of an equation that will show what happened in the problem. Ask what it stands for.

2 Have pupils look at the picture. Explain that it shows Bill putting his new cars with the 11 he already has. Let someone read aloud the sentence opposite the picture.

3 Be sure pupils understand that the *plus* sign and screen show that an unknown number of cars has been added to the original 11.

4 Draw attention to the picture and have a child read aloud the sentence opposite it.

5 Draw attention to the equation and statements. Ask why "14" is put after the *equals* sign. Point out that the equation is now complete, and the missing number can now be found.

6 Have pupils refer to the picture as they read the accompanying text.

89

1 Tell the children to look at this picture and read the sentence opposite it. Help them see that the ring separates the original 11 cars from the total group of 14. Draw attention to the green 11 and its accompanying statement.

2 Explain that the dimming off means they are to imagine that the 11 cars have been taken away and that only the new cars are left. Have the children look at the computational form and the statement at the right to see how this "taking away" is shown with numerals. Let them subtract.

3 Have pupils look at the finished computation and its explanatory text.

4 Draw attention to this equation and its explanations. Call on a child to read the completed equation aloud and explain what each number stands for in terms of the original problem.

5 Work through this problem with the class. Have pupils explain what each number in the equation stands for in terms of the problem.

1

D At the toy store Ann counted 23 china dogs on a table. A clerk put more china dogs with them. Then Ann counted 31 china dogs. How many did the clerk put on the table?

E Ellen needed 26 toys for a party. She bought 17 of them on Monday and the others on Tuesday. How many toys did she buy on Tuesday?

F Tom had 43 marbles. He bought a new bag of marbles at the toy store. Then he had 68 marbles. How many marbles did he buy at the toy store?

G Jim bought a book with 52 pages in it. He said he would finish reading it before lunch. So far he has read 37 pages. How many more pages does he have to read?

H Carol spent $1.72 at the toy store. Don spent $1.91 at the toy store. How much more money did Don spend than Carol?

I Together, Carol and Don bought 51 small toys for a fish pond. Carol bought 27 of them. How many of these small toys did Don buy?

J Peggy paid $2.35 for a doll bed and a buggy. She paid $.98 for the bed. How much did she pay for the buggy?

K Bill needed $1.30 to buy an airplane kit. He had only 35¢. How much more money did he need before he could buy the airplane kit?

L The fourth graders want to earn $15 to buy a record player. They have earned $9.42. How much more money do they need to earn?

M The children want 30 records for the record player they are buying. Carol's mother gave them 17 records. How many more records do they want?

N Bob needed 75¢ to buy a present for his sister. He had 59¢. How much more money did he need?

O Nancy needed $1.50 to buy a doll. She had $.89. How much more money did she need before she could buy it?

P Dick had 18 old coins last week. He bought some more old coins this week. Now he has 26 old coins. He bought how many old coins this week?

Q John had $.48. The puzzle he wanted to buy cost $.85. How much more money did he need to buy it?

R Jim wanted to buy a model boat that cost $.85. He had $.48. Jim needed how much more money to buy the boat?

2

In these problems you were finding how many things were added or how many more things are needed.

90

90

1 Let the children work the problems on thi page independently. Tell them to read eac problem carefully first and then to write a equation with a screen (or square) in place o the number they must find. Then have ther do the necessary computation and rewrit the equation, including the missing number.

2 When all the children have finished, write th correct answers on the board and let ther verify their work. Find out which problem caused difficulty, and discuss them with th class. In the discussion, have the children ex plain what the numbers and screens stand fo in the equations they have written for eac problem that caused trouble. They should rea ize that Problems H, I, and J do not involv additive situations.

91 Looking back

Expanded Notes for this lesson are on pages 278-279.

Objectives

The child reviews what he has learned about changing measures to larger and smaller units.

Vocabulary

New words page 91 syrup

Comments

Children often have difficulty in reducing measures, that is, in changing units to an equivalent number of larger units or to an equivalent number of smaller units. Much of this difficulty is caused by their failure to relate such problems to problem types they already know. Pupils often tend to think that measurement situations belong to an isolated class that can be coped with only by a rote application of rules. They must be given help in realizing that these problems involve multiplicative and divisive situations with which they are already familiar and require a type of thinking they have already learned to use in solving nonmeasurement problem

In changing units to an equivalent number of small units, the child should learn to think in terms of th *group* of smaller units that is equal to one of the origina units. Once he is aware of the number of units in eac group and the number of equal groups, he should easil recognize that finding the number of smaller units i the combined groups is a simple matter of multiplica tion. To change units to an equivalent number of larg units, he must ask himself how many of the original uni there are in one of the larger units. Knowing the numbe in the total group and the number in each of the equ groups, he should have no difficulty in realizing th division will provide the answer.

This lesson on the reduction of measures aims to tea the child how to analyze problems of this type. No ne number facts are introduced to complicate his tas

It may help the child understand what he is doin and prevent his resorting to trial-and-error procedur if he is required to write equations for the reduction

He should be required to do this until he does understand. For example, to reduce 18 feet to yards, he should write the equation 18÷3=▒. He should be able to explain that the 3 represents the number of feet in each group (yard) and the ▒ represents the number of groups of 3, or the number of yards. To change 6 yards to feet, he should write the equation 6×3=▒. He should be able to explain that the 6 represents the number of groups of feet, the 3 represents the number of feet in each group (or yard), and the ▒ represents the total number of feet.

Answers

(block 2)

A 4 weeks	I 7 gallons	P 3 weeks
B 5 yards	J 27 feet	Q 9 yards
C 36 quarts	K 32 pints	R 20 quarts
D 2 gallons	L 8 yards	S 12 pints
E 28 days	M 35 days	T 6 yards
F 16 pints	N 16 pints	U 3 gallons
G 7 yards	O 7 quarts	V 18 pints
H 2 weeks		

Looking back

This lesson will help you to check up on what you know about measures.

A farmer sold 2 gallons of syrup. This was equal to how many quarts? 1

THINK Each gallon is equal to a group of 4 quarts. 2 gallons are equal to 2 groups of 4 quarts. 2×4=▒. The 2 gallons of syrup were equal to ▒ quarts of syrup.

Another farmer sold 8 pints of syrup. This was equal to how many quarts? 2

THINK Each group of 2 pints is equal to 1 quart. 8 pints are equal to ▒ groups of 2 pints. 8÷2=▒. The 8 pints of syrup were equal to ▒ quarts.

3 weeks are equal to how many days? 3

THINK Each week is equal to a group of ▒ days. 3 weeks are equal to 3 groups of 7 days. 3×7=▒

27 feet are equal to how many yards? 4

THINK Each group of 3 feet is equal to ▒ yard. 27 feet are equal to ▒ groups of 3 feet. 27÷3=▒

4 yards are equal to how many feet? 4

35 days are equal to how many weeks? 3

A 28 days = ▒ weeks 5
B 15 feet = ▒ yards
C 9 gallons = ▒ quarts
D 16 pints = ▒ gallons
E 4 weeks = ▒ days
F 8 quarts = ▒ pints
G 21 feet = ▒ yards
H 14 days = ▒ weeks
I 28 quarts = ▒ gallons
J 9 yards = ▒ feet
K 4 gallons = ▒ pints
L 24 feet = ▒ yards
M 5 weeks = ▒ days
N 2 gallons = ▒ pints
O 14 pints = ▒ quarts
P 21 days = ▒ weeks
Q 27 feet = ▒ yards
R 5 gallons = ▒ quarts
S 6 quarts = ▒ pints
T 18 feet = ▒ yards
U 24 pints = ▒ gallons
V 9 quarts = ▒ pints

91

1 Tell the children to refer to Picture A as they read this problem and the explanatory material below it. Be sure they understand that it would take a group of 4 quart bottles to hold the syrup in each of the gallon containers. Help them discover why they must multiply 4 by 2 to solve the problem. Call on someone to read the text aloud, saying the missing numbers.

2 Have pupils refer to Picture B as they read the text. Be sure they understand that they divide 8 by 2 to solve the problem because each group of 2 pints is equal to one quart. Let a child read the text aloud, supplying answers.

3 Remind the children to think of a week as equal to a group of 7 days.

4 Remind them to think of each group of 3 feet as equal to one yard in working this problem.

5 Call on pupils at random to solve these exercises orally. Then, if you wish, have them write the answers opposite their identifying letters.

92-94 Exploring problems

Expanded Notes for this lesson are on pages 279-280.

Objectives

The child learns to solve problems in which he must find the number of items there were to begin with, when he knows the number of items added and the number that resulted after they were added.

Vocabulary

New words page 93 wonder*; page 94 start*, during*, summer*, sent*, radio

Comments

This is another type of problem in which the action in the situation is additive, but which is solved by subtraction. In these problems the size of the original group is not known; but a group of known size is added to it, and the size of the resulting group is known. It is a kind of problem that is met both in real situations and in textbooks, and, unless special care is exercised, many children find it difficult and confusing.

This type of problem shows very clearly why making an equation is the first important step in problem solving. To make the equation, the child must think the problem through. The equation must accurately represent the situation; therefore the child must understand the action of the problem in order to write the equation. He must learn to put the screen in the proper place in the equation. He must then be able to copy the numbers from the equation in the correct form for computation. His ability to do these two things demonstrates his understanding of the problem.

The "See" step in this lesson (and other lessons of this type) is designed to show the children how to analyze a problem in setting up the equation. The "Compute" step then shows them how the computation (which may involve a process different from the one indicated in the equation) is carried out.

It should be noted, incidentally, that in many of the lessons which introduce a certain type of problem, all of the problems are not necessarily of that type. For example, Problems J and K on page 94 are not of the same type as the others in the lesson, and therefore they require a different equation. Different problem types within such a set of problems are purposely included in order to prevent the pupils from mechanically writing the same type of equation for all problems within the set.

Answers

Exploring problems:

Note that numerals representing money in the equations are shown with the dollar sign and point (M). The child should be permitted to write these numerals in his equation in the form in which they appear in the problem (▤+42¢=$1.06) and to show his answer in either form in the equation—with the cents' sign (64¢) or with the dollar sign and point ($.64) as he has it in his computation.

A [47]+35=82
B [31]+18=49
C [18]+14=32
D [194]+25=219
E [12]+4=16
F [29]+22=51
G [58]+14=72
H [19]+12=31
I [$1.69]+$.36=$2.05
J $.87+[$2.08]=$2.95
K 31−7=[24]
L [17]+18=35
M [$.64]+$.42=$1.06

Keeping skillful:

A 1220
B 181
C 339
D 993
E 254
F 653

Exploring problems

see

Jim had some baseball cards. Bill gave him 15 more baseball cards. Now Jim has 41 baseball cards. How many cards did he have to begin with? 1

A

You do not know how many cards Jim had at first.

B

Number of cards Jim had at first 2

Bill gave him 15 more cards.

3

□ + 15 — Number of cards Bill gave him

C

Now Jim has 41 cards.

□ + 15 = 41 — Number of cards Jim has now; You must find this number.

4

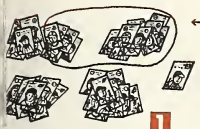
compute 5

D

You know Jim has 41 cards now.

41 — Number of cards he has now

Reteaching of finding the number of items to begin with when the number of items added and the number of items resulting are known

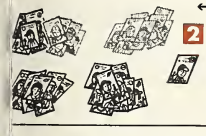


E

Think of a group of cards equal in number to the cards Bill gave to Jim.

15 — Number of cards Bill gave to Jim

1



F

Imagine that this group of 15 cards is gone.

41
15 — Subtract 15 from 41.
□

2

41
15 3 The number left shows how many cards Jim had at first.
26 — He had 26 cards at first.

□ + 15 = 41 — This number is 26. Jim had 26 cards at first. 4

A After Bill was given 35 new stamps for his collection, he had 82 stamps. How many did he have to begin with?

Number of stamps Bill had at first.
Number of stamps given to Bill. 5
□ + 35 = 82 — Number of stamps he has now.
You must find this number.

Imagine that the 35 stamps are gone.
Subtract 35 from 82.
Bill had □ stamps at first.

B Don had a collection of old coins. He got 18 more old coins for his birthday. Then he had 49 old coins. How many old coins did Don have before his birthday?

THINK How many coins do you imagine are gone? 6
□ + 18 = 49 Subtract 18 from 49.

C Peggy put 14 new butterflies in her collection today. "Now I have 32 butterflies," she said. "I wonder how many I had before." How many did she have the day before? 7

92

1 Have the children read the problem. Relate the statement under the problem to the picture. The children should observe that they cannot tell how many cards there are in the picture.

2 Begin to make the equation. Explain that first we write the screen to show that we do not know how many cards Jim had at first.

3 Have the children note that Picture B shows the next thing that happens in the problem. The hand is adding 15 cards to the unknown number already there. This is shown in the equation by "+15" at the right of the screen.

4 The problem states that now Jim has 41 cards. Have the children note that the picture shows the cards arranged as 4 groups of 10 and 1. This part of the problem is shown in the equation by "41." The children must find the number that belongs where the screen is.

5 Explain that now we are going to find out how to compute to find the unknown number. Note that Picture D is the same as Picture C.

93

1 In Picture E a ring has been drawn around 15 of the 41 cards. This is the number of cards added to the unknown number.

2 In Picture F the 15 cards that were encircled above are dimmed off. The children are to imagine that this group of cards has been taken away. They should connect this with the subtraction process.

3 Have the children verify the computation.

4 Have them read the equation, saying the missing number. Relate the equation to the problem.

5 Study and discuss the diagram of the equation. Have the children do the computation.

6 Have the children explain the equation in this problem in the way shown in Problem A.

7 Have the children do this problem independently; then check it with them to see that they have the right equation and the right answer.

D Don said, "I just put 25 new marbles in my marble box. Now I have 219 marbles." How many marbles did he have in his marble box before he put the 25 new marbles in it?

E Jim made 4 new model airplanes. Then he had 16 airplanes. How many did he have to start with?

F Ann counted her postcard collection in May. During the summer her friends sent her 22 more postcards. Then she had 51 postcards. How many did she have in May?

G Jim found 14 new stones. He put them with his old stones and found that he had 72 in all. How many of these stones were old ones?

H Sue bought a book of 12 paper dolls. Then she had 31 paper dolls. She had how many paper dolls at first?

I Last week Bob saved some money to buy a toy fire engine. This week he saved 36¢. When he put the 36¢ with the money he saved last week, he had $2.05. How much money did he save last week?

J Dick is saving money to buy a radio kit. The radio kit costs $2.95. Dick has $.87. How much more money does Dick need to buy the radio kit?

K Mary saves pictures of horses. She gave 7 of her 31 pictures of horses to Sue. Then how many pictures of horses did Mary have?

L Tom's father gave him a box of 18 pencils. Then Tom had 35 pencils. How many pencils did Tom have before his father gave him the box of 18?

M After Betty had earned 42¢, she had $1.06. How much money did she have before she earned the 42¢?

In many of these problems you were finding out how many things there were to begin with.

Keeping skillful

A	782 + 438 = ■	A	35 ÷ 7 = ■	G	36 ÷ 9 = ■	M	5 × 6 = ■
B	386 + ■ = 567	B	9 × 3 = ■	H	4 × 7 = ■	N	32 ÷ 8 = ■
C	■ + 502 = 841	C	28 ÷ 4 = ■	I	32 ÷ 4 = ■	O	4 × 5 = ■
D	615 + 378 = ■	D	30 ÷ 6 = ■	J	7 × 5 = ■	P	14 ÷ 7 = ■
E	■ + 449 = 703	E	8 × 4 = ■	K	9 × 2 = ■	Q	5 × 5 = ■
F	267 + ■ = 920	F	3 × 7 = ■	L	24 ÷ 3 = ■	R	6 × 6 = ■

94

94

1 Direct the children to work independently on Problems D to M. Have them read the problem, make the equation with the screen in the proper place, write the numbers in computational form, compute, and, finally, rewrite the equation with the missing number in it. Warn the children that some of the problems are not like the others [Problems J and K].

2 Supply answers and have the children verify their work. Discuss those problems that caused trouble. In discussing the problems, use the type of explanation of the equation shown for Problem A, page 93.

3 Direct the children to copy these numbers in computational form and compute. Tell them that they must decide in each exercise whether to add or subtract. If they have difficulty with these exercises, spend more time with problems like those on pages 88-90 and 92-94.

4 Use these exercises orally; then have the children write the answers.

95-96 Using arithmetic

Exponded Notes are not considered necessary for this lesson.

Objectives

The child practices to acquire skill in problem solving.

Vocabulary

New words page 95 pail*, rubber*, castle*, flagpole*; page 96 rode*, walked*, wading, pool*

Comments

In doing the work on pages 95 and 96, the child will practice problem solving and will get more experience in writing equations and selecting the correct arithmetic process to use with each equation. All four processes are called for in this set of problems. Problem situations of the type taught on the preceding pages are included.

With problem sets of this kind, which are planned to provide miscellaneous practice, it is always well to have the children work the problems independently first, and delay discussion until after they have made their own attempts to solve them. A detailed discussion of the problems may cause the children to lose interest in working them; so it is better to let the children work the problems before discussing them. The sets of problems labeled "Using arithmetic" are intended to be practice sets and should be treated as such, but there should always be adequate discussion of the problems when the children have completed them, and particularly of those with which several of the children have had difficulty.

In Problem L on page 95, and Problems N and R on page 96, the child learns to generalize the comparison idea by applying it to units other than counting units. He finds that he can think of feet, pounds, or degrees in the same way that he thinks of objects. In other words, to find how much larger one group is than another, he thinks of the individual objects in each group and uses certain techniques to compare the groups and solve the problem. Now he finds that the same techniques can be used to compare pounds, feet, degrees, or anything expressed in a unit of measure.

Answers

Using arithmetic:

A $.65+$.29=[$.94]
B $.89+[$.61]=$1.50
C 55¢−25¢=[30¢]
D [27]+15=42
E 226−120=[106]
F 21¢÷3¢=[7]
G 4×8=[32]
H 18÷2=[9]
I 33¢−19¢=[14¢]
J 6×2¢=[12¢]
K 27÷9=[3]
L 25−12=[13]
M 26−17=[9]
N 33−19=[14]
O 53−9=[44]
P $1.45+$1.65=[$3.10]
Q [$4.30]+$.75=$5.05
R 79−63=[16]

Keeping skillful (block 1):

A 394
B 1256
C 263
D 293
E 163
F 39
G 772
H 809
I 333
J 503
K 25
L 2365
M 81
N 1050
O 887

(block 3)

A 12 feet
B 3 weeks
C 3 quarts
D 32 quarts
E 10 pints
F 6 yards
G 7 gallons
H 14 inches long
I 20 ounces
J 32° above 0

Using arithmetic

On the way to the beach, Jim bought and pail for 29¢ and a big rubber l for 65¢. How much did these two ngs cost in all? 1
5 ⟶ $.29 = ■

A rubber horse that Jim also nted to buy cost $1.50. He had 89¢ t. How much more money did he ed to buy the rubber horse?
9 ⟶ ■ = $1.50

Ellen had 55¢ when she went the beach. She paid 25¢ for a cap. w much money did she have left?
¢ ⟶ 25¢ = ■

Sue and Ann were lookihg for shells. e said to Ann, "How many shells l you have when we started?" Ann d, "I don't know, but I have 42 now, d I found 15 today." How many ells did Ann have to start with?
⟶ 15 = 42

Bill and Tom counted the stones y found. Bill said that he had 5 stones. Tom said, "All I have is 0 stones." Bill had how many more nes than Tom?
5 ⟶ 120 = ■

Three girls shared the cost of a box popcorn equally. The popcorn cost ¢. How much did each girl pay? 2

G To make a large sand castle, each of 4 boys carried 8 pails of sand. How many pails of sand did they use to make the sand castle?

H 18 children at the beach made sand castles. 2 children worked on each castle. How many castles did they make?

I Don paid 19¢ for a rubber duck and 33¢ for a toy boat. He paid how much less for the rubber duck than for the toy boat?

J Nancy took 6 empty bottles to the beach store. The clerk gave her 2¢ for each bottle. How many cents did he give her?

K Ann makes pictures with shells. She uses 9 shells for each picture. How many pictures can she make with 27 shells she found on the beach?

L The beach house is 12 feet high. The flagpole next to it is 25 feet high. How much higher is the flagpole than the beach house?

THINK You know you subtract to find how much larger one group is than another. You also subtract to find how much higher one thing is than another. 3

95

1 Ask the children to work Problems A to E. Explain that in these problems the equations have been partly made for them and that they are to complete them by deciding which arithmetic action occurs in each problem, writing the sign for that action in the equation, doing the computation, and, finally, writing the completed equation.

2 Have the children work independently on Problems F to R (M to R are on page 96). They should write the equation, do the computation, and rewrite the equation with the computed number in it.

3 The paragraph labeled "Think" is to help the child think about the problem in the way that is necessary for solving it. Point out to the children that this paragraph goes with Problem L, and that it will help them if they have difficulty with the problem, or that they can use it to see that they have solved the problem correctly.

M 26 boys rode to the beach. 17 boys walked to it. How many fewer boys walked to the beach than rode?

N Tom said his baby sister weighed 19 pounds. Mary said her little brother weighed 33 pounds. How much less did Tom's baby sister weigh than Mary's little brother?

THINK You know you subtract to find how much smaller one group is than another. You also subtract to find how much less one thing weighs than another. 1

O Dick had 53 shells. He gave away 9 of them. How many did he have left?

P Ann earns money by looking after small children at the wading pool. One week she earned $1.45. The next week she earned $1.65. How much did she earn in the two weeks?

Q After Ann put 75¢ in her bank, she counted the money in it. She had $5.05 in all. How much money was in her bank before she put in the 75¢?

R A sign on the beach said that the temperature of the water was 63 degrees, and the temperature of the air was 79 degrees. How much colder was the water than the air? 2
79 ~~ 63 = ■

3 Keeping skillful

A 907 − 513 = ■
B 228 + 640 + 388 = ■
C 437 + ■ = 700
D 365 − 72 = ■
E 54 + 26 + 83 = ■
F ■ + 18 = 57
G 412 + 360 = ■
H 5672 − 4863 = ■
I 238 + ■ = 571
J 56 + 293 + 154 = ■
K ■ + 35 = 60
L 5000 − 2635 = ■
M 37 + 15 + 29 = ■
N 800 + 250 = ■
O 408 + 112 + 367 = ■

4

A 16 ÷ 4 = ■
B 5 × 7 = ■
C 8 × 3 = ■
D 36 ÷ 6 = ■
E 21 ÷ 7 = ■
F 24 ÷ 3 = ■
G 3 × 4 = ■
H 8 × 2 = ■
I 30 ÷ 5 = ■
J 9 × 3 = ■
K 4 × 8 = ■
L 15 ÷ 5 = ■
M 28 ÷ 4 = ■
N 2 × 7 = ■
O 36 ÷ 9 = ■

5

A 4 yards = ■ feet
B 21 days = ■ weeks
C 6 pints = ■ quarts
D 8 gallons = ■ quarts
E 5 quarts = ■ pints
F 18 feet = ■ yards
G 28 quarts = ■ gallons
H Which is longer, a stick 1 foot long or a stick 14 inches long?
I Which is more, 20 ounces of beans or a pound of beans?
J Does water freeze at 32° below 0° or 32° above 0°?

96

1 The paragraph labeled "Think" will help the pupils with Problem N and will give them a way to check their equation.

2 Discuss any of the problems on pages 95 and 96 that caused difficulty.

3 Have the children write these exercises in computational form and do the computation. Supply answers for the children to use in verifying their work. Direct them to find and correct any mistakes they may have made.

4 Call on the children at random for the answers. After each child has had a chance to respond orally, ask the children to write the answer for each basic fact beside its identifying letter on their papers.

5 These exercises can be used for oral practice. Call on the children at random, and be sure that each child responds at least once.

97 Thinking straight

Expanded Notes for this lesson are on pages 280-281.

Objectives

The child begins to learn about rounding off numbers and approximate measurements.

Vocabulary

New words page 97 nearly*, off*, better*, height

Comments

Because mathematics is a precise science and many arithmetic problems require exact answers, children sometimes get the idea that they must always have exact answers.

In some situations an exact answer about a quantity is of little value; in others, it is actually impossible to arrive at an exact answer. At the same time, there are pitfalls in using numbers to obtain approximate answers, and the child should understand what they are. One such pitfall is illustrated in Picture A on page 97. Before working with this picture, special attention should be paid to the meaning of "enough." Children will readily understand (especially in connection with the sharing of something edible) that too little will not go around. They will recognize from this that when an exact answer is not required—but it is essential to have enough—the approximation should always be made on the plus or "more than" side of the exact amount known to be needed.

It might be well to have some classroom discussion of the occasions when an approximate answer is much more appropriate than an exact answer, and vice versa. In general, approximations are used conversationally and when measuring continuous quantities such as yards, miles, gallons, etc. As examples, you might consider these two situations: When buying carpet for the hall would you use exact or approximate measurement? When telling a friend the price of a dress, would you be most likely to state the exact or an approximate price?

Children should be familiar with the following expressions, even though not all of them are used in the

text: "nearest foot," "approximate cost," "round number," and "rounding off."

When discussing rounding off numbers, be sure pupils understand the different ways in which this may be accomplished, and see that they have some oral practice in rounding off numbers to the nearest easily manageable unit—5, 10, or 100, for example. Sometimes the round number will be less than rather than greater than the number being rounded off. The exercises in the lesson require rounding off in both upward and downward directions.

Answers

A Ann looked harder at the dollar side of the point than at the cents' side. She did not round off the sum to the nearest dollar or even to the nearest half dollar.

B It is better to estimate too much rather than too little in a situation like this. Ask the class if the clerk would be satisfied to be given "about the right amount" if it fell short of the asking price.

C 6 feet

D About 11 feet

E About 4 feet

F Yes, because 900 is the nearest round number to 897.

G 80, since nothing in the situation requires the amount described to be more than the total.

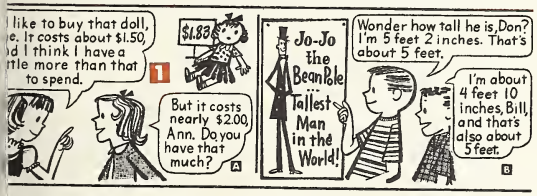
H Because they bought nearly 2 pounds.

I $19, $26; $20, $25

J 2050, since they want to be sure they have *enough* chairs.

Thinking straight

Sometimes an answer that is not exact but is nearly correct will tell you all you need to know.


like to buy that doll, e. It costs about $1.50, d I think I have a ttle more than that to spend.
$1.83
But it costs nearly $2.00, Ann. Do you have that much?
A
Jo-Jo the BeanPole ... Tallest Man in the World!
Wonder how tall he is, Don? I'm 5 feet 2 inches. That's about 5 feet.
I'm about 4 feet 10 inches, Bill, and that's also about 5 feet.
B

1 In Picture A, Sue rounded off he exact cost of the doll to the next ollar. What was wrong with the way nn rounded off the cost of the doll?

Why was Sue's way better?

2 In Picture B, each boy rounded off is height to the nearest foot. feet 2 inches to the nearest foot is feet.

Is 10 feet 11 inches about 10 feet about 11 feet?

Is 4 feet 5 inches about 4 feet about 5 feet?

3 380 children went to a school fair the morning, and 517 children went the fair in the afternoon. Ellen said, n round numbers, 900 children ent to the school fair." Was she rrect?

C Each of 48 boys and 36 girls bought an apple at the fair. Imagine that you are telling someone about how many apples they bought altogether. Which is the better round number to use, 80 apples or 100 apples? 3

H Mary bought 13 ounces of peanuts, and Don bought 14 ounces of peanuts. Why would it be wrong to say that they bought about 1 pound in all? 4

I The fourth graders earned $19.23, and the fifth graders earned $25.91. To the nearest dollar, how much did each grade earn? What other round numbers might you use for each amount? 5

J If you needed 2019 chairs for a show, which would be a better number to use when getting the chairs, 2050 chairs or 2000 chairs? Why? 6

97

1 Use Picture A in connection with Problems A and B. Discuss the terms "rounding off" and "round number." Be sure the children see why Ann did not use good judgment, as stated in the answer key.

2 Discuss the meaning of "nearest foot." Use Picture B with Problems C, D, and E.

3 Class discussion should elicit the answers provided in the answer key.

4 Have a pupil read this problem aloud. Ask the class how many ounces are in a pound and how close each child came to buying a pound of peanuts. Then ask how many peanuts, to the nearest pound, they bought altogether.

5 Discuss the problem and let the children justify their answers.

6 Be sure they understand why an approximate answer is not good unless it is more than 2019. Once they have made the correct choice between the two numbers offered, let them select a closer approximation, such as 2025 or 2020.

98-100 Thinking straight

Expanded Notes for this lesson are on pages 282-283.

Objectives

The child begins to learn how to compute mentally, and how to use short cuts to do so.

Vocabulary

New words page 98 let's*, good*, even*, right*; page 99 hard*; page 100 sharp*, seems*, our*

Comments

Mental calculation is actually much easier than it appears to be, but it requires an approach to the handling of numbers different from that used in working with pencil and paper. For example, in adding or subtracting on paper, it is customary to start with the ones' column and work through the tens to the hundreds, etc. But in mental calculation the opposite approach is usually followed: the hundreds or tens are computed first, and the ones last. This approach will not be entirely strange to the children, since it is the method they were taught to use in counting sums of money (page 73), beginning with dollars and ending with cents.

The lesson should begin with oral practice in rounding off numbers upward and downward to the nearest 5, 10, 50, 100, etc.

In working with the exercises, no child should be required to try work beyond his capacity. He should, however, be encouraged to experiment with the short cuts illustrated on pages 98 to 100, because mental calculation is a tool he will use all through his life. It is not expected that success will be achieved in this lesson or even in this grade. Your aim should be to stimulate the child's interest in the short cuts of mental calculation so that the motivation for using some of them will come from within the child himself.

Answers

Page 98:

(block 1) A When Don changed 57 to 60, he added 3 more ones. B The 30 Ann subtracted was 8 less than the amount she had to subtract. C When 38 was changed to 34, the difference of 4 still remained to be subtracted. Other ways to subtract 38 from 84: 84−40=44, 44+2=46; 80−40=40, 4+2=6, 40+6=46; 80−30=50, 50−8=42, 42+4=46; D In subtracting 30 instead of 28, you took away 2 more than you should have; so now you must add 2. 50−30=20, 20+2=22; E 58−28=30, 30−8=22

(block 2)

		(block 3)	
A 88	E 130	A 49	E 23
B 113	F 140	B 7	F 54
C 111	G 114	C 71	G 11
D 116	H 117	D 21	H 24

Page 99:

(picture) D 813+300=1113, 1113+100=1213, 1213−10=1203

(block 1) A In changing 390 to 400, she added 10. B Because so far she has added only the hundreds. After she added the tens, she still had to add the ones. D 325+300=625, 625−1=624; E 300+299=599, 600+25=625, 625−1=624; F 300+300=600, 25−1=24, 600+24=624

(block 2)

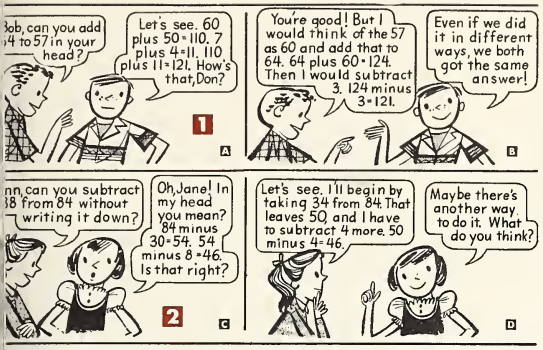
A 340	D 533	G 389	J 1838
B 1340	E 1133	H 1182	K 1553
C 820	F 609	I 1582	L 1198

Page 100:

(block 1) A To make the last 2 figures of 210 like the last 2 figures of 125, he added 15. B He took away 10 from 210 before he subtracted. Yes. 110 is 15 less than the number he has to subtract. C Because it was easier and faster. He mentally put the 25 aside to be subtracted later. D 459−259=200, 59−7=52, 200−50=150, 150−2=148; E 407−200=207, 207−57=150, 150−2=148; F Add it to 140. Because the number you subtracted was 1 too many.

(block 2)

A 23	D 129	G 97	J 264
B 107	E 58	H 177	K 58
C 100	F 208	I 266	L 139


Bob, can you add 34 to 57 in your head?
Let's see. 60 plus 50 = 110. 7 plus 4 = 11. 110 plus 11 = 121. How's that, Don?
1
A
You're good! But I would think of the 57 as 60 and add that to 64. 64 plus 60 = 124. Then I would subtract 3. 124 minus 3 = 121.
Even if we did it in different ways, we both got the same answer!
B
Ann, can you subtract 38 from 84 without writing it down?
Oh, Jane! In my head you mean? 84 minus 30 = 54. 54 minus 8 = 46. Is that right?
2
C
Let's see. I'll begin by taking 34 from 84. That leaves 50, and I have to subtract 4 more. 50 minus 4 = 46.
Maybe there's another way to do it. What do you think?
D

A In Picture B, why did Don subtract 3?

B In Picture C, why did Ann subtract 8?

C In Picture D, why did Jane subtract 4? Can you think of another way to subtract 38 from 84?

Add in your head.

A	26 + 62 = ▒	E	52 + 78 = ▒
B	17 + 96 = ▒	F	45 + 95 = ▒
C	91 + 20 = ▒	G	81 + 33 = ▒
D	69 + 47 = ▒	H	84 + 33 = ▒

4

D How would you subtract 28 from 50 in your head? One way is to begin by subtracting 30 from 50. Then what would you have to do?
50 − 30 = 20 20 ⟶ 2 = ▒

3

E Another way is to begin by subtracting 28 from 58. 58 − 28 = ▒. What would you do next?

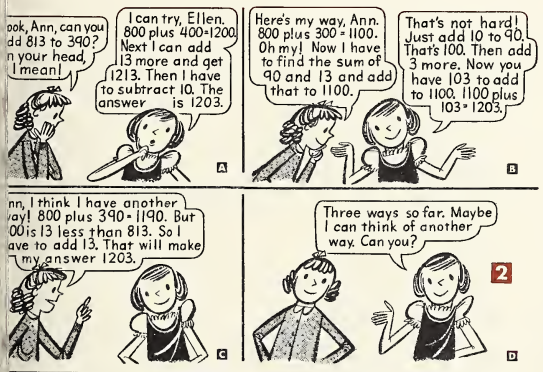
3

Subtract in your head.

A	92 − 43 = ▒	E	50 − 27 = ▒
B	71 − 64 = ▒	F	96 − 42 = ▒
C	86 − 15 = ▒	G	79 − 68 = ▒
D	35 − 14 = ▒	H	63 − 39 = ▒

4

Mental computation: addition and subtraction


Look, Ann, can you add 813 to 390? In your head, I mean!
I can try, Ellen. 800 plus 400 = 1200. Next I can add 13 more and get 1213. Then I have to subtract 10. The answer is 1203.
A
Here's my way, Ann. 800 plus 300 = 1100. Oh my! Now I have to find the sum of 90 and 13 and add that to 1100.
That's not hard! Just add 10 to 90. That's 100. Then add 3 more. Now you have 103 to add to 1100. 1100 plus 103 = 1203.
B
Ann, I think I have another way! 800 plus 390 = 1190. But 400 is 13 less than 813. So I have to add 13. That will make my answer 1203.
C
Three ways so far. Maybe I can think of another way. Can you?
2
D

A In Picture A, why did Ann have to subtract 10?

B In Picture B, why did Ellen need to find the sum of 90 and 13? When Ann added 10 to 90, why did she have to add 3 more?

C Which of these 3 ways of finding the answer do you think would be easiest for you? Why?

D How would you add 325 and 299 in your head? You might begin to add in this way: 325 + 300 = ▒. What would you do next?

4

E Another way would be to add 299 to 300. 300 + 299 = ▒. What would you need to do next to find the answer?

F Can you think of any other way to add 325 and 299?

Add in your head.

A	190 + 150 = ▒	E	631 + 502 = ▒	I	890 + 692 = ▒
B	701 + 639 = ▒	F	319 + 290 = ▒	J	975 + 863 = ▒
C	545 + 275 = ▒	G	205 + 184 = ▒	K	806 + 747 = ▒
D	423 + 110 = ▒	H	852 + 330 = ▒	L	999 + 199 = ▒

5

98

1 Let two boys act out Picture A. Ask another child to explain why Bob added 11 to the first total. The rest of the class should act as a participating audience, checking what is being said in their heads, if they can, or by making penciled notes. Proceed in the same way to dramatize Picture B, with different children for the actors. Use Exercise A in connection with this picture.

2 Let two girls dramatize Picture C and answer Question B. Follow the same procedure with different girls for Picture D and use Exercise C in this connection. Class discussion of the second question should elicit some of the possibilities listed in the answer key.

3 Class discussion should bring out answers similar to those provided in the answer key.

4 Let pairs of children choose exercises from these columns to act out for the class. Let the class decide if they have chosen a good way to do the exercise.

99

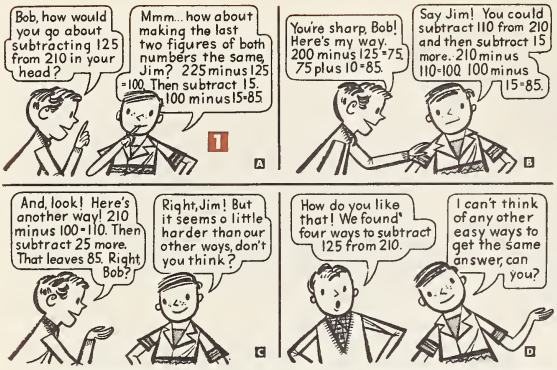
1 Let different pairs of children act out Pictures A to D, one pair to each picture, while the class checks what is being said. If children are unable to do this in their heads, allow them to use pencil and paper.

2 A fourth way is shown in the answer key.

3 Have the pupils answer the questions in Exercises A to C orally.

4 Class discussion should bring out answers similar to those provided in the answer key.

5 Select pairs of children to choose exercises from these columns to dramatize before the class. Their dialogue should be closely followed and checked for accuracy by the rest of the class. If you feel extra written work is desirable, you may use these exercises for this purpose as well.


Bob, how would you go about subtracting 125 from 210 in your head?
Mmm... how about making the last two figures of both numbers the same, Jim? 225 minus 125 = 100. Then subtract 15. 100 minus 15 = 85
1
A
You're sharp, Bob! Here's my way. 200 minus 125 = 75. 75 plus 10 = 85.
Say Jim! You could subtract 110 from 210 and then subtract 15 more. 210 minus 110 = 100. 100 minus 15 = 85.
B
And, look! Here's another way! 210 minus 100 = 110. Then subtract 25 more. That leaves 85. Right Bob?
Right, Jim! But it seems a little harder than our other ways, don't you think?
C
How do you like that! We found four ways to subtract 125 from 210.
I can't think of any other easy ways to get the same answer, can you?
D

A In Picture A, why did Bob subtract 15 from 100? **2**

B In Picture B, why did Jim add 10 to 75? Is this way easier than the way Bob tried next? Why did Bob subtract 15 from 100?

C In Picture C, why did Jim subtract 100, not 125, from 210? Why did he next have to subtract 25 from 110?

D Without using a pencil, how would you subtract 259 from 407? Begin by subtracting 259 from 459. **3**

E If you begin by subtracting 200 from 407, what will you do next?

F Another way is to round off both numbers like this: 400 − 260 = 140. Now what must you do with the 7 in 407? Why should you next add 1?

Subtract in your head. **4**

A 198 − 175 = ▭	E 313 − 255 = ▭	I 967 − 701 = ▭
B 470 − 363 = ▭	F 726 − 518 = ▭	J 690 − 426 = ▭
C 234 − 134 = ▭	G 847 − 750 = ▭	K 708 − 650 = ▭
D 570 − 441 = ▭	H 689 − 512 = ▭	L 986 − 847 = ▭

100

100

1. Let different pairs of children dramatize Pictures A to D, one pair for each picture.
2. Let the children answer the questions in Exercises A to C.
3. Class discussion should bring out answers similar to those provided in the answer key.
4. Select pairs of children to dramatize exercises from these columns before the class. Their dialogue should be closely followed by the rest of the class and checked for accuracy. Children may make penciled notes if they need to do so. These exercises may also be used for extra written work.

101 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving problems of the types taught to this point.

Vocabulary

New words page 101 pet*, too*, meal*, collar

Comments

As with other sets of problems provided for general practice, these should be thought through and solved by the children before there is any discussion of them. Such a procedure will prevent the children from losing interest in work that presents no challenge.

It is very important that the children continue to write equations for all problems, because this forces them to think about what happens before they compute and also shows very clearly what their thinking has been. Be sure that, after pupils have finished, individual and common difficulties are cleared up by discussion.

Answers

A $9 \times 4 = 36$
B $\$10.00 - \$7.85 = [\$2.15]$
C $\$.35 + \$.22 + \$.40 = [\$.97]$
D $\$10.00 - \$7.50 = [\$2.50]$
E $\$2.75 + \$.40 = [\$3.15]$ or $\$.40 + \$2.75 = [\$3.15]$
F $4 \times 8 = [32]$
G $2 \times 8 = [16]$
H $36¢ \div 4¢ = [9]$
I $3 \times 8¢ = [24¢]$
J $16 - 14 = [2]$; 2 ounces less
K $4 \times 8 = [32]$
L $19¢ + 69¢ + 15¢ = [\$1.03]$
M $16¢ \div 2¢ = [8]$
N $\$2.00 - \$1.35 = [\$.65]$
O $25¢ + [13¢] = 38¢$

Using arithmetic

The clerk at the pet store said hat one fish tank would hold 9 gallons f water. This tank would hold how any quarts of water?

When John was in the pet store, man bought a bird for $7.85. He gave he clerk a ten-dollar bill. How much oney should the clerk have given im?

John bought one fish that cost .35, another that cost $.22, and third fish that cost $.40. How much d John spend for these three fish?

Nancy came to the pet store, too. he bought a kitten for $7.50. She aid for it with a ten-dollar bill. ow much money should the clerk ave given her?

Carol bought a basket for $2.75 nd some cat food for $.40. How much all did she pay for the basket and he cat food?

Mary bought 4 small cans of cat od. Each can had 8 ounces of food it. How many ounces of cat food did he buy altogether?

Mary said that her cat eats 8 unces of food at each meal. She feeds two times a day. How many ounces f food does her cat eat each day?

H The 4 cans of cat food that Mary bought cost 36¢ in all. How much did each can cost?

I The clerk sold 3 snails to Don. The snails cost 8¢ apiece. How much did Don pay for the 3 snails?

J The clerk said that a can of dog food weighed 14 ounces. This was how much more or how much less than one pound?

K The clerk said that Nancy should give her kitten about 8 ounces of cat food each day. About how much cat food does she need to feed her kitten for 4 days?

L Dick bought some fish food for 19¢, some bird seed for 69¢, and some turtle food for 15¢. How much in all did these things cost?

M Jim bought 2 small snails. He paid 16¢ for them. How much did the snails cost apiece?

N Jim also bought a dog collar that cost $1.35. He paid for the collar with 2 one-dollar bills. How much money should the clerk have given him?

O Ann had a quarter to spend. She wanted to buy a turtle that cost 38¢. How much more money did she need?

101

101

1 Have the children work these problems, using the following procedures with each. First, read the problem and think through the situation; make an equation with the screen to show what happened; write the numbers in computational form and compute; and, finally, rewrite the equation with the missing number in it.

2 Since the action in this problem is imagined, it does not matter in what order the addends are written in the equation. Any equation that includes all the numbers, includes the proper signs, and, after computation, shows the correct answer should be accepted.

3 Discuss the problems and the equations and answers the children have written for them. Find out which problems caused trouble, and be sure the children understand them before going on.

102-104 Moving forward

Expanded Notes for this lesson are on pages 284-285.

Objectives

The child learns the multiplication basic facts for the groups 40, 42, 45, 48, and 49.

Vocabulary

New words page 104 David*

Comments

The multiplication basic facts in this lesson are the first new multiplication basic facts taught in this book. All previous lessons dealing with multiplication reviewed basic facts that had been taught in Book 3. Be sure to allow sufficient time for the children to learn the new facts thoroughly before going on to the next lesson.

The pictures that illustrate the basic facts taught in this lesson have been arranged so that a basic fact and its reverse can be taught together. The objects in each picture can be viewed either as in horizontal rows or as in vertical rows. For example, in Movie A, in the top scene there are five horizontal rows of eight shells each or eight vertical rows of five shells each. This arrangement shows the child very clearly that the total number of shells is the same whether they are regarded as 5 eights or as 8 fives.

To enable the child to know at a glance what the total quantity is, rings are drawn around groups of ten shells in the second scene in Movie A so that the child can immediately see them as 4 tens, or 40. This procedure will be used throughout this lesson and in all following lessons on multiplication basic facts.

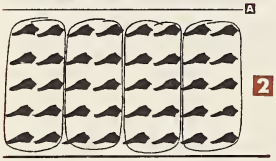
Moving forward

This lesson will show you how to multiply to make 40, 42, 45, 48, and 49.

1

There are 5 rows of 8 shells.
There are 5 eights.

There are 8 rows of 5 shells.
There are 8 fives.



2

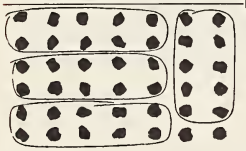
There are ■ tens, or ■ shells.

5 eights = ■
8 fives = ■
5 × 8 = ■ 8 × 5 = ■

3

There are 6 rows of 7 stones.
There are 6 sevens.

There are 7 rows of 6 stones.
There are 7 sixes.



There are ■ tens ■ ones, or ■ stones.

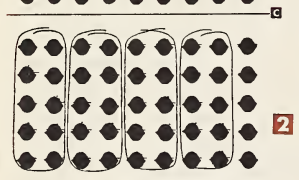
6 sevens = ■
7 sixes = ■
6 × 7 = ■ 7 × 6 = ■

102 Multiplication basic facts with products of 40, 42, 45, 48, and 49

1

There are 5 rows of 9 nuts.
There are 5 nines.

There are 9 rows of 5 nuts.
There are 9 fives.



2

There are ■ tens ■ ones, or ■ nuts.

5 nines = ■
9 fives = ■
5 × 9 = ■ 9 × 5 = ■

3

There are 6 rows of 8 pine cones.
There are 6 eights.

There are 8 rows of 6 pine cones.
There are 8 sixes.

There are ■ tens ■ ones, or ■ pine cones.

6 eights = ■
8 sixes = ■
6 × 8 = ■ 8 × 6 = ■

104

103

102

1 Direct attention to the first scene in Movie A. Get the children to notice that there are 8 shells in each row across and that there are 5 rows. Have them read the first two lines of text opposite the picture. Draw attention to the vertical arrangement of the shells and have them notice that there are 8 rows of 5 shells each. Have them read the next two lines of text.

2 Direct attention to the second scene. Get the children to notice that the arrangement of shells is the same as in the first scene, but that now there are rings around groups of ten. Have them count these groups by tens. Now they know that 8 fives equal 40 and that 5 eights equal 40. Use the text opposite the picture to help them express these facts. For practice, have children arrange dots in rows like those in the pictures, but let them put in the 4 rings in ways other than those shown.

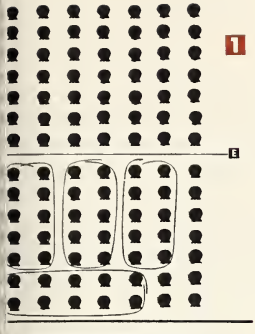
3 Use the same procedures with Movie B.

103

1 Draw attention to the first scene in Movie C. Get the children to notice that there are 5 rows of 9 nuts each. Have them read the first two lines of text opposite the picture. Point out the vertical arrangement and have them notice that there are 9 rows of 5 nuts. Have them read the next two lines of text.

2 Direct attention to the second scene. Get the children to notice that the arrangement of nuts is the same as in the first scene, but that now there are rings around groups of ten, with some single nuts left over. Have them count the nuts by saying, "10, 20, 30, 40, and 5 ones." Have them state the result as a number. Now they know that 9 fives equal 45 and that 5 nines equal 45. Use the text opposite the picture to help them express these facts. Let the children arrange dots in rows like those in the pictures, but let them practice putting rings around groups of ten dots in different ways.

3 Use the same procedures with Movie D.



There are 7 rows of 7 shells.
There are 7 sevens.

There are ■ tens ■ ones, or ■ shells.

7 sevens = ■
7 × 7 = ■

a Jane gave 8 shells to each of 5 friends. How many shells in all did she give to her 5 friends?
5 × 8 = ■

b David was saving money to buy animal pictures. He saved 7 cents a week for 7 weeks. How many cents did he save in the 7 weeks?
7 × 7 = ■

c Carol put colored leaves in a book that had 8 pages. She put 6 leaves on each page. How many colored leaves did Carol put in this book?
8 × 6 = ■

d Tom planted 9 rows of seeds in a box. He planted 5 seeds in each row. He planted how many seeds in all?
9 × 5 = ■

3

J 6 × 8 = ■
I 7 × 6 = ■
H 5 × 9 = ■
G 8 × 5 = ■
E 7 × 7 = ■

F 8 × 6 = ■
G 6 × 7 = ■
H 9 × 5 = ■
I 5 × 8 = ■

4

A Multiply 6 by 8.
B 7 sevens = ■
C 6 multiplied by 7 = ■
D Multiply 9 by 5.
E 5 multiplied by 8 = ■

F 9 × 5 = ■
G 5 × 8 = ■
H 7 × 7 = ■
I 6 × 7 = ■
J 8 × 5 = ■

Now you should be able to multiply to make 40, 42, 45, 48, and 49.

104

1 Let the children discover that the number of shells in the vertical rows is the same as the number in the horizontal rows. Use the same procedures as for the movies on the two preceding pages.

2 Have the children give the answer to the equation in Problem A. Help the children find and use the picture that shows the same number of objects as there are in the problem. Be sure they can explain which numeral in the equation stands for the size of the group and which stands for the number of groups. Proceed in the same way with the other problems.

3 All nine basic facts in this lesson are in this group of exercises. After the children have given all of the answers orally, have them write the answers on paper.

4 Have the children respond orally to all of these exercises, and then have them write the responses. Repeat the teaching procedures for any facts the children do not know.

105-107 Moving forward

Expanded Notes for this lesson are on pages 285-286.

Objectives

The child learns the division basic facts for the groups 40, 42, 45, 48, and 49.

Vocabulary

There are no new words.

Comments

The division basic facts in this lesson are the first new division basic facts taught in this book. All previous lessons dealing with division reviewed basic facts that had been taught in Book 3. Be sure to allow sufficient time, learning experiences, and practice for the children to learn the facts thoroughly. If necessary, use objects to help the children understand the ideas taught in this lesson.

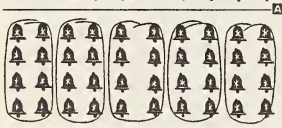
In Movie A on page 105, the child uses the same data to learn that 40 divided by 8 equals 5, and that 40 divided by 5 equals 8. Thus, the related division basic facts for 40 are taught together and are pictured in the same movie.

In each of the movies the first scene shows the total number of objects arranged in rows of ten, with a slight separation into groups of five for aid in recognition. The child finds the total number by counting the tens and any ones left over. In the second and third scenes in each movie, the objects are separated by rings into groups of whatever number is under discussion. In Movie A the second scene shows the 40 bells divided into groups of eight, and the third scene shows them divided into groups of five. The child can see, and so can understand, that when 40 is divided into groups of 8, or by 8, there are five groups, and when 40 is divided into groups of 5, or by 5, there are eight groups. This procedure is used throughout this lesson and in all following lessons on division basic facts.

Moving forward

This lesson will show you how to divide the numbers 40, 42, 45, 48, and 49.

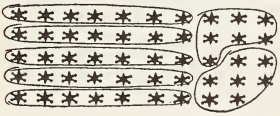
1 There are 40 bells in all.



2 The 40 bells are divided into groups of ■.
There are ■ groups of 8. 3
40 ÷ 8 = ■

4 Now the 40 bells are divided into groups of ■.
There are ■ groups of 5. 5
40 ÷ 5 = ■

6 There are 49 jacks in all.



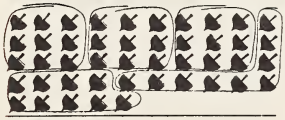
The 49 jacks are divided into groups of ■.
There are ■ groups of 7.
49 ÷ 7 = ■

1 There are 42 whistles in all.

2 The 42 whistles are divided into groups of ■.
There are ■ groups of 7. 3
42 ÷ 7 = ■

4 Now the 42 whistles are divided into groups of ■.
There are ■ groups of 6. 5
42 ÷ 6 = ■

6 There are 45 tops in all.



The 45 tops are divided into groups of ■.
There are ■ groups of 9.
45 ÷ 9 = ■

Now the 45 tops are divided into groups of ■.
There are ■ groups of 5.
45 ÷ 5 = ■

105

1 Have the children observe that the bells are arranged in rows of ten. Have them count the bells by tens to make sure there are 40 of them.

2 Get the children to observe that the bells have been divided into groups of 8, and have them count the groups to find that there are five of them. Let children draw 40 dots and practice drawing rings around groups of 8 dots in different ways.

3 Ask a child to read the text, refer to the picture, and say the missing numbers.

4 Be sure the children realize that these are the same bells. Have them observe that now the bells are divided into groups of 5, and have them count the groups to find that there are eight of them. Have the children practice drawing rings around groups of 5 dots in different ways.

5 Have a child read the text, refer to the picture, and say the missing numbers.

6 Use the same procedures for Movie B.

106

1 Have the children notice that the whistles are arranged in rows of ten with two left over. Have them count the groups of ten and note the number of ones to make sure there are 42 in all.

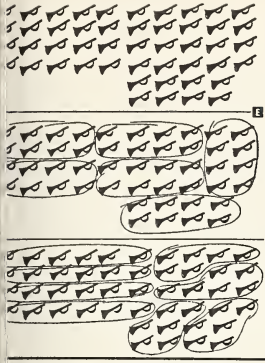
2 Have the children observe that the whistles have been divided into groups of 7 and have them count the groups to see that there are 6 of them. Again, the children may practice drawing rings around groups of 7 dots in different ways.

3 Ask one of the children to read the text, refer to the picture, and say the missing numbers.

4 Be sure the children realize that these are the same whistles. They should observe that now the whistles have been divided into groups of 6. Have them count the groups to find that there are seven of them.

5 Have a pupil read the text, refer to the picture, and say the missing numbers.

6 Use the same procedures for Movie D



There are 48 horns in all.

The 48 horns are divided into groups of ■.
There are ■ groups of 8.
48 ÷ 8 = ■

Now the 48 horns are divided into groups of ■.
There are ■ groups of 6.
48 ÷ 6 = ■

1 Ellen bought 42 shells to make shell pictures. She used 6 shells for each picture. She made how many pictures?
42 ÷ 6 = ■

2 Sue bought 48 flowers. She divided them into bunches of 8. How many bunches of flowers did she make?
48 ÷ 8 = ■

C Jim had 45¢. The tablets that he wanted cost 9¢ each. How many tablets could he have bought with his 45¢?
45 ÷ 9 = ■

D John spent 40¢ for some balloons. The balloons cost 5¢ each. How many balloons did John buy?
40 ÷ 5 = ■

3

B 45 ÷ 9 = ■	F 40 ÷ 8 = ■	A Divide 49 by 7.
D 48 ÷ 8 = ■	G 48 ÷ 6 = ■	B 42 divided by 7 = ■
H 40 ÷ 5 = ■	H 45 ÷ 5 = ■	C Divide 40 by 8.
C 42 ÷ 6 = ■	I 42 ÷ 7 = ■	D 48 divided by 6 = ■
I 49 ÷ 7 = ■		E Divide 45 by 5.

4

F 48 ÷ 8 = ■	
G 40 ÷ 5 = ■	
H 45 ÷ 9 = ■	
I 42 ÷ 6 = ■	
J 49 ÷ 7 = ■	

Now you can divide 40, 42, 45, 48, and 49.

107

107

1 Use the procedures outlined on the two preceding pages for Movie E.

2 Tell the children to read Problem A and find the answer to the equation. If necessary, permit them to find a picture that shows the same number of objects as there are in Problem A arranged in the correct groups. Let them attempt to find the right picture independently. Proceed in the same way with the other three problems.

3 All nine division basic facts taught in this lesson are included in this group of exercises. Have the children give all the responses orally and then in writing.

4 Have the children give the responses to all of these exercises orally first and then write them. Reteach any facts the children do not know.

108 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices making change, writing amounts of money, and addition and subtraction.

Vocabulary

New words page 108 Tony*

Comments

If a sufficient quantity of coins is available and the number of children makes it practical, the exercises at the top of the page can be used in class as practice in change making with real coins. However, if it is not possible to have the children use real coins, these exercises can be worked out very successfully on paper. The children should be shown on the board how to draw a circle and write a numeral in it to show the denomination of the coin it represents. Show them how to write a numeral under each such circle to tell what they would say as they count in making change.

If they have any difficulty either in counting change or in understanding this way of showing their answers, have them turn back to the lesson on pages 76-78. If they have any difficulty writing amounts of money, have them turn back to the lesson on pages 74-75.

Answers

(block 2)

A $18.35	D $3.40	G $.73 or 73¢	J $82.05
B $10.16	E $25.07	H $.50 or 50¢	
C $.09 or 9¢	F $8.00 or $8	I $31.79	

(block 3)

A 13	E 534	I 47	M 39	Q 1020
B 564	F 146	J 54	N 378	
C 14	G 24	K 70	O 53	
D 329	H 34	L 167	P 2774	

(block 4)

A 1324	E 356	I 146	M 456	Q 1442
B 19	F 292	J 141	N 215	
C 824	G 107	K 1089	O 1367	
D 816	H 79	L 39	P 50	

Keeping skillful

For each of these problems draw the coins or bills that you would give in making change. Under each coin or bill write the number you would say as you make the change.

1

A Ann bought an apple for 7¢. She gave the clerk a quarter.

2 B Don bought a dozen oranges for 49¢. He gave the clerk a quarter and 3 dimes.

C Tony bought a box of candy that cost 55 cents. He gave the clerk a dollar bill.

D Carol bought 29¢ worth of bananas. She gave the clerk a half dollar.

E Bob's mother bought a chicken that cost $4.52. She gave the clerk a 10-dollar bill.

F Jim gave the clerk a 5-dollar bill to pay for groceries that cost $3.21.

G Mary gave the clerk a dollar bill and 2 quarters to pay for a basket of peaches that cost $1.38.

H Dick gave the clerk two 1-dollar bills to pay for a basket of apples that cost $1.65.

3 Write with numerals.

A eighteen dollars and thirty-five cents

B ten dollars and sixteen cents

C nine cents

D three dollars and forty cents

E twenty-five dollars and seven cents

F eight dollars

G seventy-three cents

H fifty cents

I thirty-one dollars and seventy-nine cents

J eighty-two dollars and five cents

4

A ■ + 28 = 41
B 702 − 138 = ■
C 86 + ■ = 100
D 19 + 310 = ■
E 2373 − 1839 = ■
F 69 + 77 = ■
G ■ + 11 = 35
H 73 − 39 = ■
I 18 + ■ = 65
J ■ + 54 = 108
K 44 + 26 = ■
L 1039 − 872 = ■
M 9 + ■ = 48
N 554 − 176 = ■
O ■ + 90 = 143
P 5830 − 3056 = ■
Q 853 + 167 = ■

4

A 1726 − 402 = ■
B 72 + ■ = 91
C 498 + 326 = ■
D ■ + 77 = 893
E 825 − 469 = ■
F 326 + ■ = 618
G ■ + 38 = 145
H 508 − 429 = ■
I 57 + ■ = 203
J 63 + 78 = ■
K ■ + 111 = 1200
L 84 + ■ = 123
M 600 − 144 = ■
N 185 + ■ = 400
O 658 + 709 = ■
P ■ + 84 = 134
Q 2700 − 1258 = ■

108

108

1. Let the children decide what coins they should give in change first [3 pennies]. Then show them how to draw 3 circles and put a 1 in each. Continue in this way with the remaining coins. Next explain how to write 8, 9, 10, 20, 25¢ underneath the circles.
2. Tell them to show on their papers how to make change for each of the problems B to H. When they finish, if they have had any difficulty, let them count out the change with real money.
3. Have the children write the labels in a column on their papers and then write the correct amount of money opposite each one.
4. Have the children write the exercises in these two sets in computational form and find the answers.

109 Side trip

Expanded Notes for this lesson are on page 287.

Objectives

The child learns the abbreviations for the measurement terms he uses in this book.

Vocabulary

New words Page 109 measurement, words*, often*, abbreviations

Comments

Knowing the abbreviations for measures makes it much easier to write measurement data, particularly in exercises; and, since these abbreviations are so commonly used, the children should be able to read them.

Do not insist that the children memorize the abbreviations. Let them learn by using them over a period of time, and encourage them to refer to this page whenever they need to.

Care should be taken to avoid the use of the letter "s" at the ends of abbreviations for the plural form of the measurement words. Make sure the children understand that the same abbreviation is used for both the singular and plural. Note that the plural of the word *dozen* is not given since it rarely occurs in general usage.

Answers

(block 1)	(block 2)	(block 3)
A 60	A 32	A 9
B 8	B 7	B 21
C 52	C 393	C 37
D 1	D 1 lb. 10 oz.	D 1 da. 3 hr.
E 1	E 74	E 17
F 16	F 8	F 1 yr. 33 da.
G 12	G 1 yr. 3 mo.	G 1 yr. 26 wk.
H 1	H 7	H 1 min. 26 sec.
I 7	I 5	I 1 hr. 15 min.
J 1	J 64	J 1 ft. 9 in.
K 3	K 27	K 42
L 1	L 93	L 23
M 4	M 12	M 1 lb. 15 oz.
N 365	N 30	N 15

Side trip

Measurement words, such as inch, pound, or quart, are often written in a shorter way. These short ways of writing words are called abbreviations. **1**

inch or inches—in.
foot or feet—ft.
yard or yards—yd.

ounce or ounces—oz.
pound or pounds—lb.

pint or pints—pt.
quart or quarts—qt.
gallon or gallons—gal.

second or seconds—sec.
minute or minutes—min.
hour or hours—hr.

day or days—da.
week or weeks—wk.
month or months—mo.
year or years—yr.

dozen—doz.

12 in. = 1 ft.
3 ft. = 1 yd.
36 in. = 1 yd. **2**

12 things = 1 doz.

2 pt. = 1 qt.
4 qt. = 1 gal.
8 pt. = 1 gal.

16 oz. = 1 lb.

7 da. = 1 wk.
52 wk. = 1 yr.
12 mo. = 1 yr.
365 da. = 1 yr.

60 sec. = 1 min.
60 min. = 1 hr.
24 hr. = 1 da.

A 1 min. = ▪ sec.
B 1 gal. = ▪ pt.
C 1 yr. = ▪ wk.
D 36 in. = ▪ yd.
E 24 hr. = ▪ da.
F 1 lb. = ▪ oz.
G 1 ft. = ▪ in.
H 2 pt. = ▪ qt.
I 1 wk. = ▪ da.
J 60 min. = ▪ hr.
K 1 yd. = ▪ ft.
L 12 mo. = ▪ yr.
M 1 gal. = ▪ qt.
N 1 yr. = ▪ da.

A 4 gal. = ▪ pt. **4**
B 49 da. = ▪ wk.
C 1 yr. 28 da. = ▪ da.
D 26 oz. = ▪ lb. ▪ oz.
E 1 min. 14 sec. = ▪ sec.
F 24 ft. = ▪ yd.
G 15 mo. = ▪ yr. ▪ mo.
H 1 gal. 3 qt. = ▪ qt.
I 40 pt. = ▪ gal.
J 1 yr. 12 wk. = ▪ wk.
K 1 lb. 11 oz. = ▪ oz.
L 1 hr. 33 min. = ▪ min.
M 1 doz. = ▪ things
N 90 min. = 1 hr. ▪ min.

A 36 qt. = ▪ gal. **5**
B 1 ft. 9 in. = ▪ in.
C 1 da. 13 hr. = ▪ hr.
D 27 hr. = ▪ da. ▪ hr.
E 1 yr. 5 mo. = ▪ mo.
F 398 da. = ▪ yr. ▪ da.
G 78 wk. = ▪ yr. ▪ wk.
H 86 sec. = ▪ min. ▪ sec.
I 75 min. = ▪ hr. ▪ min.
J 21 in. = ▪ ft. ▪ in.
K 6 wk. = ▪ da.
L 1 yr. 11 mo. = ▪ mo.
M 31 oz. = ▪ lb. ▪ oz.
N 1 gal. 7 pt. = ▪ pt.

109

1 Ask the children to read the three lines of text at the top of the page. Direct attention to the tables of abbreviations. Point out that all units of measurement for the same kind of thing are together: inches, feet, and yards; ounces and pounds; etc. Explain that an abbreviation is two or three letters of the word with a period after them to show that the word is not complete. Get pupils to notice that the abbreviation always suggests the complete word. Point out that the abbreviation is the same whether the word is singular or plural.

2 Explain to the children that this table contains all the measures they have learned so far.

3 Have the children respond to all of these exercises first orally and then in writing. These equivalents require no reductions.

4 These exercises should be written. They involve changes to larger or smaller units.

5 These exercises should also be written. They are more difficult than those in block 2.

110-113 Moving forward

Expanded Notes for this lesson are on page 287.

Objectives

The child learns the multiplication basic facts for the groups 54, 56, 63, 64, 72, and 81.

Vocabulary

New words page 113 until*, prizes*

Comments

These multiplication basic facts are taught here for the first time, and the products are larger than any the child has had to deal with previously. As in the preceding lesson on new multiplication basic facts, the objects in the pictures are arranged so that a fact and its reverse can be taught together, and so that immediate recognition of the total quantity is possible. Since these facts may be more difficult to learn than any which the children have had in prior work on multiplication, be sure to allow ample time and ample learning activities for pupils to learn them thoroughly before going on.

For practice, have the children arrange dots in rows like those shown in the pictures, but let them put in the rings in ways other than those shown.

In the second and last blocks of exercises, point out that exercises such as D and G (second block) and D, F, G, etc. (last block), may be solved by subtraction. For example, for Exercise D (26 oz. = ▪ lb. ▪ oz.) the solution is: 16 oz. = 1 lb.; 26 oz. = 26 oz. − 16 oz. = 1 lb. 10 oz.

Answers

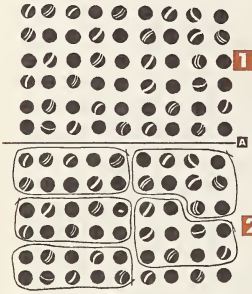
Keeping skillful:

(block 1)
A 6
B tens'
C 8
D thousands'
E 6

(block 3)
A $2.02
B $2.43
C 1013
D 923
E $6.89
F 145
G 55
H 493
I $2.00
J 1157
K 1786
L $3.37

Moving forward

In this lesson you will learn how to multiply to make 54, 56, 63, 64, 72, and 81.



There are 6 rows of 9 balls.
There are 6 nines.

There are 9 rows of 6 balls.
There are 9 sixes.

There are ▪ tens ▪ ones, or ▪ balls.

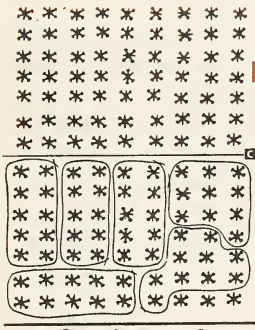
6 nines = ▪
9 sixes = ▪
6 × 9 = ▪ 9 × 6 = ▪

There are 7 rows of 8 blocks.
There are 7 eights.

There are 8 rows of 7 blocks.
There are 8 sevens.

There are ▪ tens ▪ ones, or ▪ blocks.

7 eights = ▪
8 sevens = ▪
7 × 8 = ▪ 8 × 7 = ▪

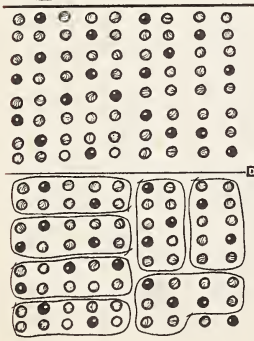


There are 7 rows of 9 jacks.
There are 7 nines.

There are 9 rows of 7 jacks.
There are 9 sevens.

There are ▪ tens ▪ ones, or ▪ jacks.

7 nines = ▪
9 sevens = ▪
7 × 9 = ▪ 9 × 7 = ▪



There are 8 rows of 9 marbles.
There are 8 nines.

There are 9 rows of 8 marbles.
There are 9 eights.

There are ▪ tens ▪ ones, or ▪ marbles.

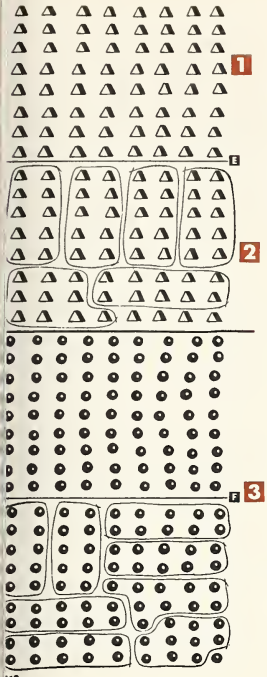
8 nines = ▪
9 eights = ▪
8 × 9 = ▪ 9 × 8 = ▪

110

1. Direct attention to the first scene in Movie A. Get the children to notice that there are 6 horizontal rows and that there are 9 balls in each row. Have them read the first two lines of text opposite the picture. Then draw attention to the vertical arrangement of the balls and have them notice that there are 9 rows of 6 balls. Have them read the next two lines of text.
2. In the second scene, have the children notice that the arrangement of balls is the same, but that now there are rings around groups of ten. Have them count these groups by tens and count the ones left over. Now they know that 6 nines equal 54 and that 9 sixes equal 54. Use the text opposite the picture to help them express these facts.
3. Use the same procedures with Movie B.

111

1. Direct attention to the first scene in Movie C. Have the children notice that there are 7 horizontal rows and that there are 9 jacks in each row. Have them read the two lines of text opposite the picture. Then draw attention to the vertical arrangement of the jacks, and have them notice that there are 9 rows of 7 jacks each. Have them read the next two lines of text.
2. Direct attention to the second scene. Get the children to observe that the arrangement of jacks is the same, but that now there are rings around groups of ten. Have them count these groups by tens and count the ones left over. Now they know that 7 nines equal 63 and that 9 sevens equal 63. Use the text opposite the picture to help them express these facts.
3. Use the same procedures with Movie D.



There are 8 rows of 8 blocks.
There are 8 eights.

There are ■ tens ■ ones, or ■ blocks.

8 eights = ■
8 × 8 = ■

There are 9 rows of 9 marbles.
There are 9 nines.

There are ■ tens ■ one, or ■ marbles.

9 nines = ■
9 × 9 = ■

112

1 A Jim said to his mother, "It is exactly 8 weeks until my birthday. That is the same as 56 days." Was Jim right?
8 × 7 = ■

B Nancy bought 8 packages of paper cups. There were 8 cups in a package. There were how many cups in all?
8 × 8 = ■

C Tom bought 9 bags of small toys for a party. There were 6 toys in each bag. There were how many toys in all?
9 × 6 = ■

D Tom also bought 7 small prizes for the party. The prizes cost 9¢ each. They cost how much in all?
7 × 9 = ■

2

3

A 9 × 7 = ■	F 7 × 9 = ■	F 9 × 6 = ■	
B 6 × 9 = ■	G 8 × 7 = ■	G 7 × 9 = ■	
C 7 × 8 = ■	H 9 × 6 = ■	H 8 × 7 = ■	
D 9 × 8 = ■	I 8 × 9 = ■	I 9 × 8 = ■	
E 8 × 8 = ■	J 9 × 9 = ■	J 9 × 7 = ■	

4

A Multiply 9 by 8.	
B 8 multiplied by 7 = ■	
C 9 times 9 = ■	
D Multiply 8 by 8.	
E 6 nines = ■	

Now you should be able to multiply to make 54, 56, 63, 64, 72, and 81.

Keeping skillful

1

A In 8620, the figure ■ is in hundreds' place.

B In 2473, the figure 7 is in what place?

C In 908, the figure ■ is in ones' place.

D In 2531, the figure 2 is in what place?

E In 6310, the figure ■ is in thousands' place.

5

A 5 × 4 = ■	
B 3 × 3 = ■	
C 6 × 7 = ■	
D 6 × 3 = ■	
E 5 × 5 = ■	
F 8 × 6 = ■	
G 7 × 9 = ■	
H 6 × 6 = ■	
I 8 × 7 = ■	
J 9 × 9 = ■	
K 4 × 9 = ■	
L 7 × 7 = ■	

6

A $.72 + $.41 + $.89 = ■	
B $2.65 + ■ = $5.08	
C 486 + 527 = ■	
D 2470 − 1547 = ■	
E $8.14 − $1.25 = ■	
F 54 + 18 + 73 = ■	
G 639 − 584 = ■	
H ■ + 216 = 709	
I 83¢ + 50¢ + 67¢ = ■	
J 654 + 386 + 117 = ■	
K 5000 − 3214 = ■	
L $4.63 + ■ = $8.00	

112

1 Direct attention to the first scene in Movie E. Have the children notice that, viewed horizontally or vertically, there are 8 rows of eight blocks. Have them read the text opposite the picture.

2 In the second scene, have the children notice that the arrangement of blocks is the same, but that now there are rings around groups of ten. Have them count these groups by tens and note how many ones are left over. Now they know that 8 eights equal 64. Use the text opposite the picture to help them express this fact.

3 Use the same procedures with Movie F.

113

1 Have the children give the missing number in the equation. If necessary, help them to find and use the picture [page 110, Movie B] that shows the same number of objects in the arrangement called for in the problem. Be sure they can explain which number in the equation stands for the size of the group and which stands for the number of groups.

2 Proceed in the same way for Problems B, C, and D.

3 All ten basic facts taught in this lesson are in these two sets of exercises. Have the children respond orally and then write the responses. Repeat the teaching procedures for any facts that the children do not know.

4 Have the children respond orally.

5 Use these first as oral and then as written work.

6 Have the children write the exercises in computational form and compute. Remind them that they must decide for each exercise which process to use.

114-117 Moving forward

Expanded Notes for this lesson are on page 288.

Objectives

The child learns the division basic facts for the groups 54, 56, 63, 64, 72, and 81.

Vocabulary

New words page 115 beads

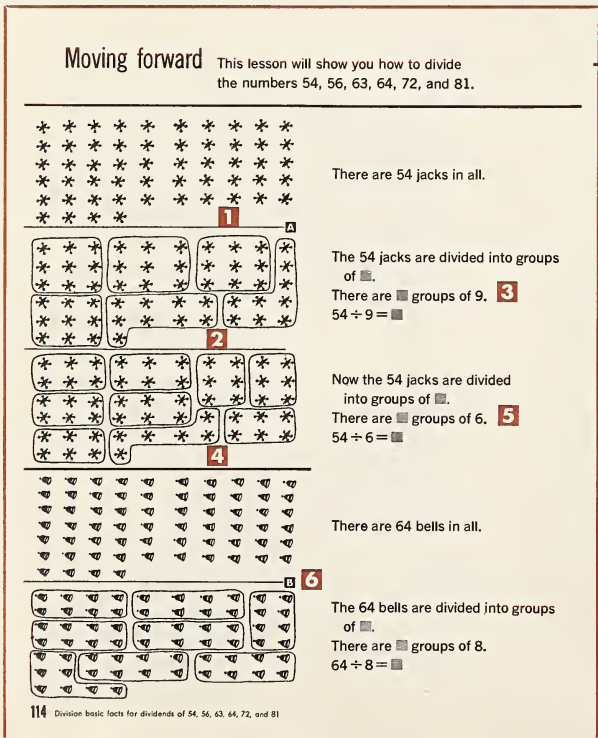
Comments

The division basic facts in this lesson are taught for the first time, and in learning them the child must deal with numbers larger than any of those he has previously encountered in division.

As in the lesson on new division basic facts on pages 105-107, the objects in the pictures are arranged so that related facts are taught together and by the same pictures. For example, in Movie A on page 114, the child learns that $54 \div 9 = 6$ and $54 \div 6 = 9$. In each of the movies the first scene shows the number of objects to be divided arranged in rows of ten and extra ones, with a slight separation into groups of five for aid in recognition. The child finds the total number by counting the tens and extra ones left over. In the second and third scenes in each movie the objects are divided by rings into equal groups. In Movie A the second scene shows the jacks divided into groups of 9, and the third scene shows them divided into groups of 6. The child can see that when 54 is divided into groups of 9, there are 6 groups; and when 54 is divided into groups of 6, there are 9 groups.

Since these basic facts may be more difficult to learn than any which the children have had in prior work in division, be sure to allow ample time and practice for pupils to learn them before going on.

For additional practice, have the children arrange dots in rows like those in the pictures, but let them put in the rings in ways other than those shown.


Moving forward
This lesson will show you how to divide the numbers 54, 56, 63, 64, 72, and 81.
There are 54 jacks in all.
1
A
The 54 jacks are divided into groups of ■.
There are ■ groups of 9.
3
54 ÷ 9 = ■
2
Now the 54 jacks are divided into groups of ■.
There are ■ groups of 6.
5
54 ÷ 6 = ■
4
There are 64 bells in all.
B
6
The 64 bells are divided into groups of ■.
There are ■ groups of 8.
64 ÷ 8 = ■
114 Division basic facts for dividends of 54, 56, 63, 64, 72, and 81

114

1 Have the children observe that the jacks are arranged in rows of ten. Have them count the groups of ten and then the ones to make sure there are 54 jacks.

2 Have the children note that the jacks have been divided into groups of 9, and have them count the groups to find that there are six.

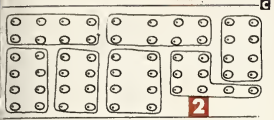
3 Ask a pupil to read the text, refer to the picture, and say the missing numbers.

4 Be sure the children realize that these are the same jacks. Have them observe that now they are divided into groups of 6. Have them count the groups to find that there are nine groups.

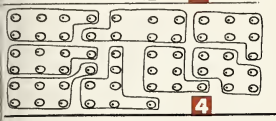
5 Let a child read the text, refer to the picture, and say the missing numbers.

6 Use the same procedures for Movie B.

There are 56 beads in all.

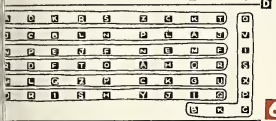


The 56 beads are divided into groups of ■.
There are ■ groups of 8.
56 ÷ 8 = ■

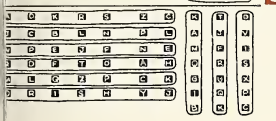


Now the 56 beads are divided into groups of ■.
There are ■ groups of 7.
56 ÷ 7 = ■

There are 63 blocks in all.



The 63 blocks are divided into groups of ■.
There are ■ groups of 9.
63 ÷ 9 = ■

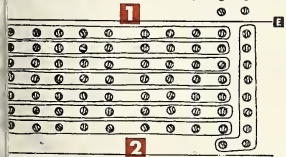


Now the 63 blocks are divided into groups of ■.
There are ■ groups of 7.
63 ÷ 7 = ■

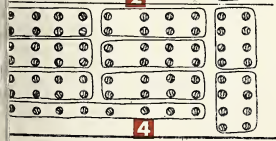
115

1. Get the children to observe that the beads are arranged in rows of ten. Have them count the groups of ten and then the ones to make sure there are 56 beads in all.
2. The children should observe that the beads have been divided into groups of 8. Tell them to count the groups to find how many there are.
3. Have a child read the text, refer to the picture, and say the missing numbers.
4. Be sure the children realize that these are the same beads. Have them observe that they have been divided into groups of 7. Ask them to count the groups.
5. Have someone read the text, refer to the picture, and say the missing numbers.
6. Use the above procedures for Movie D.

There are 72 marbles in all.

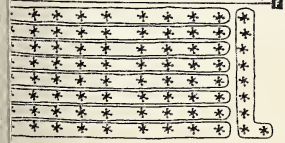


The 72 marbles are divided into groups of ■.
There are ■ groups of 9.
72 ÷ 9 = ■



Now the 72 marbles are divided into groups of ■.
There are ■ groups of 8.
72 ÷ 8 = ■

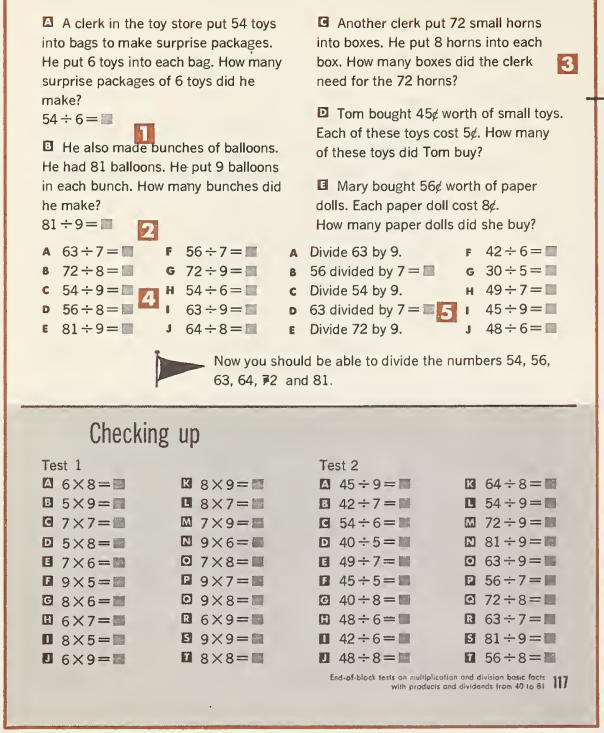
There are 81 jacks in all.



The 81 jacks are divided into groups of ■.
There are ■ groups of 9.
81 ÷ 9 = ■

116

1. Have the children observe that the marbles are arranged in rows of ten. Have them count the groups of ten and then the ones to make sure that there are 72 marbles.
2. The children should see that the marbles have been divided into groups of 9. Have them count the groups to find how many there are.
3. Ask a pupil to read the text, refer to the picture, and say the missing numbers.
4. Be sure the children realize that these are the same marbles. Have them observe that they have been divided into groups of 8. Let them count the groups.
5. Have someone read the text, refer to the picture, and say the missing numbers.
6. Use the above procedures with Movie F.



A A clerk in the toy store put 54 toys into bags to make surprise packages. He put 6 toys into each bag. How many surprise packages of 6 toys did he make?
54 ÷ 6 = ■

B He also made bunches of balloons. He had 81 balloons. He put 9 balloons in each bunch. How many bunches did he make?
81 ÷ 9 = ■

C Another clerk put 72 small horns into boxes. He put 8 horns into each box. How many boxes did the clerk need for the 72 horns?

D Tom bought 45¢ worth of small toys. Each of these toys cost 5¢. How many of these toys did Tom buy?

E Mary bought 56¢ worth of paper dolls. Each paper doll cost 8¢. How many paper dolls did she buy?

A	63 ÷ 7 = ■	F	56 ÷ 7 = ■	A	Divide 63 by 9.
B	72 ÷ 8 = ■	G	72 ÷ 9 = ■	B	56 divided by 7 = ■
C	54 ÷ 9 = ■	H	54 ÷ 6 = ■	C	Divide 54 by 9.
D	56 ÷ 8 = ■	I	63 ÷ 9 = ■	D	63 divided by 7 = ■
E	81 ÷ 9 = ■	J	64 ÷ 8 = ■	E	Divide 72 by 9.

F	42 ÷ 6 = ■
G	30 ÷ 5 = ■
H	49 ÷ 7 = ■
I	45 ÷ 9 = ■
J	48 ÷ 6 = ■

Now you should be able to divide the numbers 54, 56, 63, 64, 72 and 81.

Checking up

Test 1

A	6 × 8 = ■	K	8 × 9 = ■
B	5 × 9 = ■	L	8 × 7 = ■
C	7 × 7 = ■	M	7 × 9 = ■
D	5 × 8 = ■	N	9 × 6 = ■
E	7 × 6 = ■	O	7 × 8 = ■
F	9 × 5 = ■	P	9 × 7 = ■
G	8 × 6 = ■	Q	9 × 8 = ■
H	6 × 7 = ■	R	6 × 9 = ■
I	8 × 5 = ■	S	9 × 9 = ■
J	6 × 9 = ■	T	8 × 8 = ■

Test 2

A	45 ÷ 9 = ■	K	64 ÷ 8 = ■
B	42 ÷ 7 = ■	L	54 ÷ 9 = ■
C	54 ÷ 6 = ■	M	72 ÷ 9 = ■
D	40 ÷ 5 = ■	N	81 ÷ 9 = ■
E	49 ÷ 7 = ■	O	63 ÷ 9 = ■
F	45 ÷ 5 = ■	P	56 ÷ 7 = ■
G	40 ÷ 8 = ■	Q	72 ÷ 8 = ■
H	48 ÷ 6 = ■	R	63 ÷ 7 = ■
I	42 ÷ 6 = ■	S	81 ÷ 9 = ■
J	48 ÷ 8 = ■	T	56 ÷ 8 = ■

End-of-block tests on multiplication and division basic facts with products and dividends from 40 to 81 117

117

1 Have the children read Problem A and give the answer to the equation. If necessary, help them to find the picture that shows the same number of objects arranged in the correct groups [page 114, Movie A].

2 Use the same procedure with Problem B.

3 For Problems C, D, and E use the same procedure as for Problems A and B, except that the children are to make their own equations.

4 All ten division basic facts taught in this lesson are in this set of exercises. Have the children give the responses orally first, and then have them write them.

5 Use these exercises for oral response and then for written response.

117 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his ability to respond to the multiplication and division basic facts with products and dividends from 40 to 81.

Vocabulary

There are no new words.

Comments

These are tests of knowledge and accuracy. The children should be allowed ample time to complete their work. Ask them to copy the labeling letter for each basic fact and write the answer opposite it. You may ask them to write the equation with the answer in place of the screen if you prefer.

It is of first importance to the child's future success in arithmetic that he know all the basic facts, since he will be unable to do even simple computation correctly if he does not. These tests will show up any weaknesses a child may have, and time should be spent reteaching those facts with which he has any difficulty before proceeding. Each child should make a list of the facts he has trouble with and then cross off each fact as he learns it. The lessons that can be used in reteaching the facts used in these tests are listed in the keyed notes for this page.

A A clerk in the toy store put 54 toys into bags to make surprise packages. He put 6 toys into each bag. How many surprise packages of 6 toys did he make?
54 ÷ 6 = ■

B He also made bunches of balloons. He had 81 balloons. He put 9 balloons in each bunch. How many bunches did he make?
81 ÷ 9 = ■

C Another clerk put 72 small horns into boxes. He put 8 horns into each box. How many boxes did the clerk need for the 72 horns?

D Tom bought 45¢ worth of small toys. Each of these toys cost 5¢. How many of these toys did Tom buy?

E Mary bought 56¢ worth of paper dolls. Each paper doll cost 8¢. How many paper dolls did she buy?

A	63 ÷ 7 = ■	F	56 ÷ 7 = ■	A	Divide 63 by 9.	F	42 ÷ 6 = ■
B	72 ÷ 8 = ■	G	72 ÷ 9 = ■	B	56 divided by 7 = ■	G	30 ÷ 5 = ■
C	54 ÷ 9 = ■	H	54 ÷ 6 = ■	C	Divide 54 by 9.	H	49 ÷ 7 = ■
D	56 ÷ 8 = ■	I	63 ÷ 9 = ■	D	63 divided by 7 = ■	I	45 ÷ 9 = ■
E	81 ÷ 9 = ■	J	64 ÷ 8 = ■	E	Divide 72 by 9.	J	48 ÷ 6 = ■

Now you should be able to divide the numbers 54, 56, 63, 64, 72 and 81.

Checking up

Test 1

1

A	6 × 8 = ■	K	8 × 9 = ■
B	5 × 9 = ■	L	8 × 7 = ■
C	7 × 7 = ■	M	7 × 9 = ■
D	5 × 8 = ■	N	9 × 6 = ■
E	7 × 6 = ■	O	7 × 8 = ■
F	9 × 5 = ■	P	9 × 7 = ■
G	8 × 6 = ■	Q	9 × 8 = ■
H	6 × 7 = ■	R	6 × 9 = ■
I	8 × 5 = ■	S	9 × 9 = ■
J	6 × 9 = ■	T	8 × 8 = ■

Test 2

2

A	45 ÷ 9 = ■	K	64 ÷ 8 = ■
B	42 ÷ 7 = ■	L	54 ÷ 9 = ■
C	54 ÷ 6 = ■	M	72 ÷ 9 = ■
D	40 ÷ 5 = ■	N	81 ÷ 9 = ■
E	49 ÷ 7 = ■	O	63 ÷ 9 = ■
F	45 ÷ 5 = ■	P	56 ÷ 7 = ■
G	40 ÷ 8 = ■	Q	72 ÷ 8 = ■
H	48 ÷ 6 = ■	R	63 ÷ 7 = ■
I	42 ÷ 6 = ■	S	81 ÷ 9 = ■
J	48 ÷ 8 = ■	T	56 ÷ 8 = ■

End-of-block tests on multiplication and division basic facts with products and dividends from 40 to 81 117

117

1 Test on the multiplication basic facts with products from 40 to 81 [taught on pages 102-104 and 110-113]. You will note that Exercises A to J include no products larger than 54 and that Exercises K to T include no products smaller than 54.

2 Test on the division basic facts with dividends of 40 to 81 [taught on pages 105-107 and 114-117]. You will note that Exercises A to J include no dividends larger than 54 and that Exercises K to T include no dividends smaller than 54.

118-119 Moving forward

Expanded Notes for this lesson are on pages 289-290.

Objectives

The child learns more about division with remainders and develops skill in mental division.

Vocabulary

New words page 118 teach*

Comments

By the time children enter fourth grade, they have already had some experience with uneven division. In this lesson, the child's knowledge and use of uneven division are extended to include all of the division basic facts but do not go beyond this range. For example, 49 is the largest number divisible by 5 within the range of the basic facts involving 5 (49 ÷ 5 = 9 and 4 remainder). This lesson includes division by 5 through 49, by 7 through 69, by 8 through 79, and by 9 through 89.

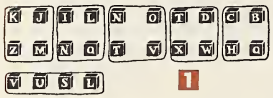
All the division in this lesson involves situations in which the child knows the size of the equal groups and must find the *number* of equal groups and the remainders. This type of division has been used in all the teaching of division basic facts.

In finding the answers to the problems and exercises on these two pages, the child should not use the computational form. He is expected to compute mentally. He may respond by saying the answers aloud or by writing out the answers.

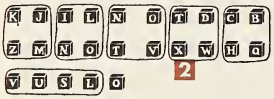
In the pictures on page 118, rings are used to show the equal groups into which the total group has been divided. You may want to supplement the work with these pictures by providing real objects for the children to manipulate. Such a method has the advantage of letting each child make the actual physical division with his own hands.

Moving forward

This lesson will teach you how to divide when you have something left over.

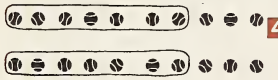


A Put the 24 blocks in groups of 4.
There are ■ groups of 4.
24 ÷ 4 = ■



B Put the 25 blocks in groups of 4.
There are ■ groups of 4.
Are any blocks left over?
The 1 block left over is called the remainder. 3
25 ÷ 4 = 6 and 1 remainder

C Put the 33 tops in groups of 6.
There are ■ groups of 6.
Are any tops left over?
33 ÷ 6 = ■ and ■ remainder



D Put the 20 balls in groups of 7.
There are ■ groups of 7.
Are any balls left over?
20 ÷ 7 = ■ and ■ remainder

1

A Which numbers can be divided by 4 without a remainder?
28 29 30 31 32 33 34 35 36

B Which numbers can be divided by 5 without a remainder?
14 15 16 17 18 19 20 21 22

C Which numbers can be divided by 6 without a remainder?
36 37 38 39 40 41 42 43 44

D Which numbers can be divided by 2 without a remainder?
13 16 9 4 8 11 17 14 5 6

E Which numbers can be divided by 3 without a remainder?
6 10 14 18 9 13 12 4 28

F Which numbers can be divided by 4 without a remainder?
29 20 8 6 16 11 24 28 31

G Which numbers can be divided by 7 without a remainder?
28 21 40 25 14 34 49 43 56

H Which numbers can be divided by 8 without a remainder?
40 18 37 32 48 20 36 56 64

I Which numbers can be divided by 9 without a remainder?
32 45 27 50 39 40 51 60 63

2

A Is there a remainder when you divide 26 by 4?

B Is there a remainder when you divide 73 by 8?

C Is there a remainder when you divide 43 by 5?

D Is there a remainder when you divide 11 by 3?

E Is there a remainder when you divide 81 by 9?

F Is there a remainder when you divide 56 by 6?

G Is there a remainder when you divide 45 by 8?

H Is there a remainder when you divide 63 by 7?

3

A 28 ÷ 5 = ■ and ■ remainder
B 51 ÷ 7 = ■ and ■ remainder
C 15 ÷ 2 = ■ and ■ remainder
D 39 ÷ 8 = ■ and ■ remainder
E 46 ÷ 9 = ■ and ■ remainder
F 38 ÷ 4 = ■ and ■ remainder
G 14 ÷ 3 = ■ and ■ remainder
H 11 ÷ 2 = ■ and ■ remainder
I 52 ÷ 6 = ■ and ■ remainder
J 79 ÷ 9 = ■ and ■ remainder
K 36 ÷ 5 = ■ and ■ remainder
L 50 ÷ 8 = ■ and ■ remainder
M 26 ÷ 4 = ■ and ■ remainder
N 38 ÷ 7 = ■ and ■ remainder

Now you should know how to divide when there is a remainder.

118

1 Ask the children how many blocks there are in all. Note that there are 10 in each row. Then draw their attention to the fact that these blocks have been put into groups of 4. Let them discover that all the blocks are included in these groups of 4. Ask, "Are there any left over?" Have someone read and complete the sentences at the right.

2 Ask the children how many blocks there are in all and what size groups they have been put into. Let them discover that there are 6 groups of 4 blocks and that 1 block is left over.

3 Either let one child read aloud all the material at the right or have several children take turns reading the sentences, saying the missing numbers in place of the screens.

4 Work with this picture and the accompanying text in the same way.

119

1 Have the children say in turn the numbers that can be divided without a remainder in each case. You might also require the children to write, opposite the labeling letters A to I on their papers, the numbers that they can divide without remainders. If advisable, this exercise may be extended by having the children take turns saying the quotient and the remainder for the numerals in each exercise. For example, in A the child would say, "7 and no remainder, 7 and 1 remainder, 7 and 2 remainder, 7 and 3 remainder, 8 and no remainder, 8 and 1 remainder, 8 and 2 remainder, 8 and 3 remainder, 9 and no remainder." Or you might say, "Let's look at A, 33." The child should respond, "8 and 1 remainder."

2 Let the children take turns answering these, or they may answer by putting *yes* or *no* opposite the labeling letters on their papers.

3 Use this for oral work first; then tell the children to write the answers.

120-123 Exploring problems

Expanded Notes for this lesson are on pages 291-292.

Objectives

The child learns how to find the size of equal groups when the total number and the number of equal groups are known.

Vocabulary

New words page 122 movie; page 123 persons, magazines

Comments

The type of division taught in this lesson is that in which the size of the equal groups must be found. It is often called sharing (partitive) division. This may be a new idea for some children. It will not be entirely new to the children who have had this program in the third grade.

In this book all the teaching of the division basic facts was based on situations in which the size of the equal groups was known (measurement division). The child had to find out how many equal groups there were. For example, how many groups of 2 apples can be made from a group of 12 apples? The solution can be demonstrated with actual apples (or other objects) by forming groups of 2 apples and counting these groups. The equation for this problem is $12 \div 2 = \square$. In general, for problems of this type the equation takes the following form: total number ÷ number in each group = number of groups.

In the sharing type of division, which is presented in this lesson, the size of the equal groups is unknown. For example, if 12 apples are to be shared equally by 6 boys, how many will each boy get? Here the total number of apples is 12, the number in each of the equal groups is to be found, and the number of equal groups is 6. Using the same form, you have for this problem the equation $12 \div \square = 6$. It is important to notice that the screen now comes at the right of the division sign.

In this problem the numbers are so small that we know immediately that the answer is 2. However, when the numbers are larger, it is not so easy to know the answer. For example, suppose 147 apples are to be shared equally by 3 boys; that is, divided into 3 equal groups. The equation is $147 \div \square = 3$. We do not know without computing how many apples should be put into each group to make 3 equal groups. We cannot form one of the equal groups, then another, and finally the third, and so demonstrate the solution in three simple steps. To demonstrate the solution of this problem with objects would require many steps—49, to be exact.

The method of solving this type of problem with objects is indirect. In this example, if each boy takes 1 apple, a group of 3 apples is taken. Suppose each boy takes another apple and they keep repeating this process. Each boy accumulates a pile of apples, and after 49 steps the apples will be equally divided. There will be 49 apples in each group. Notice that children can solve this problem by using objects even if they do not know how to divide 147. However, this example is not intended for the pupils, but only to illustrate for you that the difficulty in the problem is a genuine one.

To solve this problem by arithmetic, we notice that 3 apples are taken each time. We then ask: How many groups of 3 are there in 147? This is the measurement type of problem, and we can divide 147 by 3. The answer is 49, and so we have learned indirectly by arithmetic that each boy will get 1 apple a total of 49 times, or each boy will get a group of 49 apples.

Similarly, in the easier example mentioned above, where 12 apples are to be shared by 6 boys, or $12 \div \square = 6$, one round of sharing among 6 boys amounts to forming a group of 6 apples. Indirectly the question becomes: 12 apples will make how many groups of 6 apples? The answer, 2, tells the number of "rounds" and also how many apples each boy will get.

The purpose of the work on pages 120-123 is to help the children understand this type of situation and the method by which it is solved.

Note that this treatment has both a "See" and a "Compute" section. In the "See" section we show the child how to make the equation, and in the "Compute" section we explain why he can compute the way he does.

Answers

Page 123:

D $15 \div [5] = 3$
E $16 \div [4] = 4$
F $42¢ \div [7¢] = 6$
G $3 \times 9 = [27]$
H $18 \div [3] = 6$
I $36¢ \div [9¢] = 4$
J $56 \div [8] = 7$
K $15 \div [3] = 5$
L $27 \div [9] = 3$
M $40 \div 8 = [5]$

see

A

Bob, Dick, and John are going to share 24 stamps. Each boy is going to get the same number of stamps. How many stamps will each boy get? 1

There are 24 stamps in all.

24 2 — Number of stamps in all

B

The boys are dividing the stamps into equal groups. You do not know how many stamps there will be in each group. 3

$24 \div \square$ — Number of stamps in each group

C

There will be as many equal groups of stamps as there are boys. You know that there will be 3 equal groups of stamps. 4

$24 \div \square = 3$ — Number of equal groups of stamps; You must find this number.

compute

D

There are 24 stamps in all. 1

2

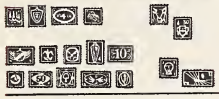
E

Now each boy has taken 1 stamp. The boys have taken a group of 3 stamps.

3

F

Each boy has taken another stamp. They have taken another group of 3 stamps.



G

Now the boys have finished sharing the stamps. Each time the boys took 1 stamp apiece, they took a group of 3 stamps. You can think of the 24 stamps as divided into groups of 3. 4

24 divided by 3 = 8

Now turn the page.

120

1 Tell the children to read the problem. By discussion relate the problem to the picture.

2 Emphasize the fact that this number tells how many stamps there are in all, and that the 24 stamps are going to be divided into equal groups.

3 Direct the children to read this text and then refer to Picture B. Be sure they understand that the objective is to divide the stamps into 3 equal groups, but that we do not know how many stamps there will be in each group. Emphasize this as the reason for using the screen at this point.

4 Have the children read this text and relate it to Picture C. Let the children see that now the stamps have been put into 3 equal groups, but that we do not know how many are in each group. Point out that the 3 in the equation shows that there are 3 groups.

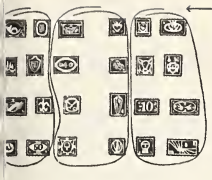
121

1 Let the children count the stamps to see that there are 24 of them.

2 Be sure the children understand that each boy has taken 1 stamp. Point out that *a group of 3 stamps* has been taken away from the supply—that when each boy has taken the first stamp of his share, a group of 3 has been taken away from the whole group.

3 Let the children see that each boy has taken another stamp and another group of 3 has been taken away. Explain that the boys will continue doing this until all the stamps are gone. Explain that we do not know as yet how many times they will do this.

4 Have the children read the text, look at the picture, and find that the boys removed 8 groups of 3 stamps. In other words, each boy got one stamp from each of the 8 groups of 3 stamps, or 8 stamps. Go through this with objects to help the children understand what happened.



Each boy has taken 8 stamps.

H

1 $24 \div \square = 3$

You now know that to find this number you divide 24 by 3.

I

$24 \div \square = 3$

This number is 8, because the stamps are divided into groups of 8.

2

Each boy will get 8 stamps.

A Four girls shared 32 flower postcards equally. How many flower postcards did each girl get? 3

Number in all.
Number in each group.
Number of equal groups.
You must find this number.

$32 \div \square = 4$

Divide 32 by 4.
Each girl got ■ flower postcards.

B Peggy paid 48¢ for 8 cupcakes. The cupcakes cost how many cents apiece? 4

THINK 48¢ = how many pennies? How many equal groups of pennies did Peggy spend? Find how many pennies there were in each group.
$48 \div \square = 8$ Divide 48 by 8.

C David paid 25¢ for 5 tickets to a movie at school. The tickets cost how many cents apiece?
$25 \div \square = 5$ Divide 25 by 5. 4

D Jim has 3 plant boxes in his window garden. He has 15 plants. He wants to put the same number of plants in each box. How many plants should he put in each box? 1

E Ann's mother made 16 cupcakes. 4 persons shared them equally. How many cupcakes did each person get?

F Nancy paid 42¢ for 6 yards of ribbon. How many cents a yard did the ribbon cost?

G Carol bought 3 spools of ribbon. Each spool had 9 yards of ribbon on it. How many yards of ribbon did Carol buy? 2

H Ellen and five of her friends had a picnic in the yard. They had 18 sandwiches. If they shared them equally, how many sandwiches did each of the 6 girls get?

I Four girls bought a box of popcorn for the picnic. They paid 36¢ for it and shared the cost equally. How much did each girl pay?

J David had 56 baseball cards. He shared them equally with 6 other boys. How many baseball cards did each of the 7 boys get?

K Tony gave 15 of his old magazines to 5 boys. He gave each boy the same number of magazines. How many magazines did each boy get?

L Mary had 3 vases and 27 flowers. She put the same number of flowers in each vase. How many flowers did she put in each vase?

M Jack bought 40 hamburger buns for a picnic. The buns were sold in packages of 8. How many packages of buns did Jack buy? 2 3

Now you should be able to find how large the equal groups are when you know the number of things in all and the number of equal groups.

Keeping skillful

4

A $63 \div \square = 7$	F $54 \div \square = 6$	A $49 \div 7 = \square$	F $36 \div \square = 9$
B $42 \div \square = 6$	G $56 \div \square = 8$	B $63 \div \square = 9$	G $72 \div \square = 8$
C $72 \div \square = 9$	H $48 \div \square = 6$	C $45 \div \square = 5$	H $54 \div 9 = \square$
D $40 \div \square = 5$	I $35 \div \square = 5$	D $56 \div 7 = \square$	I $42 \div \square = 7$
E $64 \div \square = 8$	J $81 \div \square = 9$	E $40 \div 8 = \square$	J $45 \div 9 = \square$

122

1 Have the children look at the picture. Be sure they understand that each boy has 8 stamps in all. Relate the equation to the fact that to find the missing number, they can divide 24 by 3. Take care that the children see that they are dividing by the 3 because 3 tells how many stamps were taken away each time the boys took 1 apiece.

2 Let the class see that each boy's share is 8 stamps and that the missing number is 8. Have the children complete the equation by writing $24 \div 8 = 3$.

3 Discuss the equation. Be sure the children understand why the numbers and screen have been put where they are. When you discuss dividing 32 by 4, make sure they understand what the 4 represents—that it is the number of postcards that will be taken away from the supply when each girl takes 1.

4 Follow the same procedure you did with Problem A.

123

1 Let the children work independently on Problems D to M. They should read the problem, think about the situation, make the equation with the screen in it, find the answer, and rewrite the equation with the missing number in place of the screen.

2 Be sure the children understand the difference between this problem and the other problems in the set.

3 Find out which problems caused the most difficulty and discuss them with the class.

4 Use these exercises for oral work first. Then, if you wish, you may also use them for written work.

124-125 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his understanding of all the problem types taught thus far. He also tests his knowledge of the basic facts and of all the computational processes he has learned up to this point. He tests his skill in reduction of measures.

Vocabulary

New words page 124 Friday*, scrapbook*, ice-cream*

Comments

The midpoint of this book makes a logical point at which to check up on the children's progress by means of achievement tests.

Two of these tests are on problem solving. One each of the types of problems taught so far is included in each test. (These different problem types are listed on page 347 of this *Teaching Guide* and also in the index of the pupils' book.) One way to handle these problem-solving tests is to use Test 1 to discover what the weaknesses are. Then, before going on, you can go back and reteach and review the types of problems with which the children have had trouble. Then you can give Test 2 to see what improvement has taken place. Note that the problems have been restricted to the basic facts to enable you to concentrate on the children's reasoning without the interference of computation.

The tests on page 125 are power tests; give the children sufficient time to enable them to finish the work easily. Use as many of these tests in one day as you think wise, but all of them will probably be too much work for one day.

Reteaching chart

This chart will help you locate the pages in the pupils' book to use for reteaching for whatever weaknesses the tests reveal.

Page 124:

(Test 1)

Problem	Pages	Problem	Pages
A	86-87	E	120-123
B	42-43	F	52-53
C	92-94	G	66-67
D	28-29	H	88-90

(Test 2)

Problem	Pages	Problem	Pages
A	42-43	E	86-87
B	28-29	F	120-123
C	52-53	G	92-94
D	66-67	H	88-90

Page 125:

Test	Pages	Test	Pages
1	49-51	7	18-19, 20-23,
2	102-104, 110-113		24-27
3	55-59, 60-65	8	32-35, 36-41,
4	105-107, 114-117		45, 54
5	120-123	9	20-23, 24-27,
6	55-59, 60-65,		88-90, 92-94
	105-107, 114-117,	10	118-119
	120-123	11	91, 109

Answers

Page 124:

Test 1

A 13−5=[8]
B 12−3=[9]
C [4]+3=7
D 4+8=[12]
E 24÷[6]=4
F 7×2¢=[14¢]
G 40¢÷5¢=[8]
H 2+[9]=11

Test 2

A $.18−$.09=[$.09]
B 9+8=[17] or
8+9=[17]
C 8×3¢=[24¢]
D 36÷4=[9]
E 17−8=[9]
F 9÷[3]=3
G [$.06]+$.09=$.15
H $.08+[$.07]=$.15

Page 125:

Test 7

A 84
B 92
C 797
D 877
E 180
F 905
G 590
H 120
I 1326

Test 8

A 91
B 341
C 363
D 149
E 562
F 474
G 877
H 52
I 803

Test 9

A 146
B 565
C 211
D 120
E 148
F 12
G 372
H 952
I 561

Test 10

A 6 and 1 rm.*
B 7 and 2 rm.
C 2 and 5 rm.
D 5 and 1 rm.
E 7 and 4 rm.
F 9 and 4 rm.
G 9 and 2 rm.
H 9 and 3 rm.
I 9 and 2 rm.

Test 11

A 4 pt.
B 21 oz.
C 2 gal.
D 1 ft. 2 in.
E 35 da.
F 19 in.
G 20 qt.
H 14 mo.
I 1 yd. 3 in.

*"Remainder" is indicated by the abbreviation "rm."

Checking up

Test 1 **1**

A Bob had 5 snails and 13 goldfish. He had how many fewer snails than goldfish?

B Dick had 12 snails. He gave 3 of them to Tom. How many snails did Dick have left?

C May had some plants in a window box. Her mother gave her 3 more plants. Then she had 7 plants. How many plants did May have to begin with?

D Jane had 4 plants in a window box. She put 8 more plants in the box. How many plants were in the box then?

E The children in the science class planted the same number of bean seeds in each of 4 boxes. They had 24 beans. They planted how many beans in each box?

F Ann sold 7 old magazines to friends for 2¢ apiece. She got how much in all for the magazines?

G Carol spent 40¢ for paper dolls. The dolls cost 5¢ apiece. How many paper dolls did Carol buy?

H John made 2 model cars on Friday. On Saturday he finished some more. Then he had 11 model cars. How many model cars did he finish on Saturday?

Test 2 **3**

A Betty had $.18. She spent $.09 for ribbon. How much money did she have left?

B Tom had 9 stamps. Bill had 8 stamps. Together the boys had how many stamps?

C Jane bought 8 picture postcards for 3¢ apiece. How much in all did she pay for these postcards?

D Jane pasted 36 postcards in a scrapbook. She put 4 cards on each page. How many pages of the scrapbook did she use?

E Bill counted 17 birds in his yard on Friday and 8 birds on Saturday. How many more birds did he count on Friday than on Saturday?

F Ann gave 9 paper dolls to Mary, Carol, and Jane. She gave each girl the same number of dolls. How many paper dolls did each girl get?

G After Ann earned 9¢ by helping her mother, she found she had $.15. How much money did Ann have before she earned the 9¢?

H Tom wanted to buy an ice-cream cone that cost $.15. He had only $.08. How much more money did he need?

Checking up

Test 1 **1**

A 6×4=■
B 3×8=■
C 9×4=■
D 3×7=■
E 6×5=■
F 8×4=■
G 3×9=■
H 5×5=■
I 4×7=■

Test 2 **2**

A 5×9=■
B 8×7=■
C 6×8=■
D 8×8=■
E 7×9=■
F 6×7=■
G 9×9=■
H 6×9=■
I 7×7=■

Test 3 **3**

A 18÷3=■
B 24÷8=■
C 32÷4=■
D 36÷6=■
E 28÷7=■
F 14÷2=■
G 25÷5=■
H 27÷9=■
I 24÷4=■

Test 4 **4**

A 42÷7=■
B 54÷9=■
C 64÷8=■
D 45÷5=■
E 42÷6=■
F 72÷8=■
G 40÷5=■
H 49÷7=■
I 63÷9=■

Test 5 **5**

A 36÷■=6
B 54÷■=6
C 81÷■=9
D 48÷■=8
E 40÷■=5
F 72÷■=8
G 45÷■=5
H 63÷■=9
I 56÷■=7

Test 6 **6**

A 42÷7=■
B 18÷■=3
C 63÷9=■
D 72÷8=■
E 64÷■=8
F 24÷6=■
G 40÷5=■
H 49÷■=7
I 30÷■=5

Test 7 **7**

A 46+38=■
B 5+20+67=■
C 422+375=■
D 308+569=■
E 95+78+7=■
F 216+689=■
G 275+315=■
H 7+53+60=■
I 890+436=■

Test 8 **8**

A 183−92=■
B 800−459=■
C 536−173=■
D 725−576=■
E 807−245=■
F 903−429=■
G 2864−1987=■
H 300−248=■
I 6551−5748=■

Test 9 **9**

A 28+■=174
B 456+109=■
C ■+219=430
D 580+■=700
E 58+90=■
F ■+99=111
G 140+■=512
H 719+233=■
I ■+119=680

Test 10 **10**

A 25÷4=■ and ■ remainder
B 58÷8=■ and ■ remainder
C 19÷7=■ and ■ remainder
D 46÷9=■ and ■ remainder
E 39÷5=■ and ■ remainder
F 58÷6=■ and ■ remainder
G 29÷3=■ and ■ remainder
H 39÷4=■ and ■ remainder
I 83÷9=■ and ■ remainder

Test 11 **11**

A 2 qt. = ■ pt.
B 1 lb. 5 oz. = ■ oz.
C 16 pt. = ■ gal.
D 14 in. = ■ ft. ■ in.
E 5 wk. = ■ da.
F 1 ft. 7 in. = ■ in.
G ■ qt. = 5 gal.
H ■ mo. = 1 yr. 2 mo.
I 39 in. = ■ yd. ■ in.

124

1 Give this test without a time limit. Direct each child to make an equation for the problem, put in a screen (or square) for the missing number, find the missing number, and then rewrite the equation with the missing number in it.

2 Give the children the correct answers, and let them verify their own answers. Determine which problems have given them the most trouble. Then refer to the Reteaching Chart on page 120 and do whatever reteaching is necessary.

3 After reteaching to overcome any weaknesses revealed in Test 1, you may give this test in the same way as Test 1. Check again to see if some problems still cause trouble, and if necessary do some more reteaching for those children who need it.

125

1 This is a test on the multiplication basic facts with products up to 36.

2 This test is on multiplication basic facts with products of 40 to 81.

3 This test is on division basic facts through dividends of 36.

4 This test is on division basic facts with dividends of 40 to 81.

5 In this division test, the child must find the size of the equal groups.

6 This is a mixed test on division. In some cases the child must find the size of the equal groups; in others, the number of equal groups.

7 This test is on addition.

8 This is a test on subtraction.

9 This is a test on different types of equations arising from additive problem situations.

10 This test is on division with remainders.

11 This is a test on the reduction of measures.

126-128 Moving forward

Exponded Notes for this lesson ore on pages 292-295.

Objectives

The child extends his knowledge of the number system through 9 places, including the millions' place. He learns to read and write numbers of these sizes.

Vocabulary

New words page 126 millions

Comments

In the preceding treatment on the number system (pages 11-15), the child learned to read and write numerals up to 9999. Now he will learn to read and write numerals up to 999,999,999. Enough use is made of pictures in this treatment to help the child understand the magnitude of these larger numbers.

Help the children to discover that when we have a number of three figures, such as 125, we say something for each of those numerals. For example, we say, "one *hundred* for 1, *twenty* (*-ty* means tens) for 2, and *five* for 5." We simply say "one hundred twenty-five." When we extend this number to three more figures, we still read the three figures "one hundred twenty-five" and then say "thousand." In other words, if we had the number 125,125, we would read it "one hundred twenty-five thousand, one hundred twenty-five." Then, if we extend this number to three more figures, we read it "one hundred twenty-five *million*, one hundred twenty-five *thousand*, one hundred twenty-five." Stress the fact that we read each group of three figures the same way (as if it were only hundreds). Point out that the group of three figures second from the right has the name "thousands," and the next group has the name "millions." You might even mention that this goes on and on—that each additional group of three figures has a special name.

Keep in mind that the word "and" is going to be reserved for the decimal point in reading numbers; that we do not say "and" between "one hundred" and "twenty" in the figure 120, but that we read it "one hundred twenty."

The important objective of this lesson is to help the child understand the *system* so that he can read any number if he knows the name of the group it belongs to—like "thousands," "millions," etc. In the exercises (blocks 1 and 2) on pages 127 and 128, note how the thousands are shown in red and the hundreds in black. On page 128, the millions are shown in black, too. If you wish, you may duplicate this arrangement on the chalkboard with additional sets of numbers.

Answers

Page 127:

(block 3)

A 70,000	G 896	M 16,402	S 2407
B 13,000	H 30,020	N 25,130	T 900,203
C 300,000	I 610,000	O 814,006	U 65,810
D 700,000	J 14,001	P 924,002	V 70,007
E 60,008	K 101,000	Q 200,041	
F 47,000	L 500,720	R 510,100	

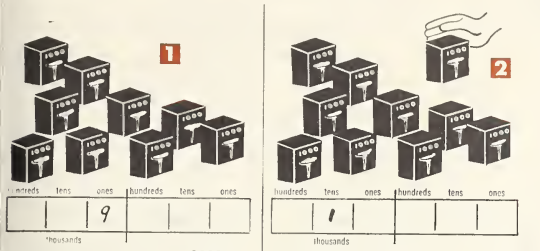
Page 128:

(block 4)

A 7,060,108	D 388,000,500	G 999,000,056
B 20,500,016	E 790,000,030	
C 41,009,220	F 52,078,008	

Moving forward

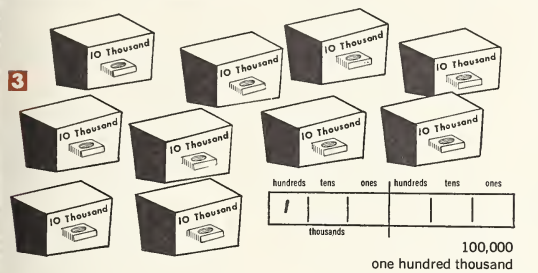
This lesson shows you how to read and write numerals that mean thousands or millions.



9000
nine thousand

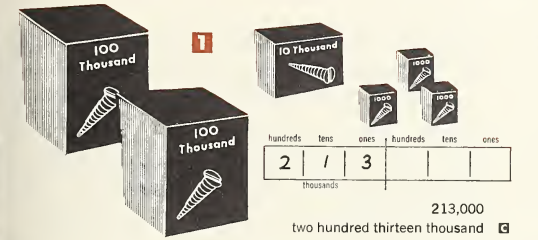
A

10,000
ten thousand



100,000
one hundred thousand

B



213,000
two hundred thirteen thousand

C

Say thousand. **2**

A	25,436
B	481,217
C	16,590
D	30,401
E	128,007
F	73,200
G	49,080

Read. **3**

A	18,213
B	800,050
C	800,500
D	630,004
E	259,000
F	701,408
G	942,671
H	512,492
I	5400
J	260,070
K	500,005
L	905,102
M	71,698
N	8777

4

O	84,001
P	212,090
Q	67,500
R	9010
S	429,308
T	216,005
U	50,070

Write with numerals. **5**

- A seventy thousand
- B thirteen thousand
- C three hundred thousand
- D seven hundred thousand
- E sixty thousand eight
- F forty-seven thousand
- G eight hundred ninety-six
- H thirty thousand twenty
- I six hundred ten thousand
- J fourteen thousand one
- K one hundred one thousand
- L five hundred thousand seven hundred twenty
- M sixteen thousand four hundred two
- N twenty-five thousand one hundred thirty
- O eight hundred fourteen thousand six
- P nine hundred twenty-four thousand two
- Q two hundred thousand forty-one
- R five hundred ten thousand one hundred
- S two thousand four hundred seven
- T nine hundred thousand two hundred three
- U sixty-five thousand eight hundred ten
- V seventy thousand seven

126

1 Ask, "How many boxes of 1000 tacks are there?" Let the children discover where the 9 has been put in the tally spaces. Discuss how we have arranged for six figures by separating the first three places at the right from the last three spaces at the left by a longer line. Have them read this number as "nine thousand."

2 Have the class note that another box of 1000 tacks has been brought in. Explain that we could put a 10 in the ones' space under "thousands," but that we do not put anything larger than 9 in any space. Instead we put a 1 in the tens' space under "thousands." Teach the children to read this number as "ten thousand."

3 Ask the class how many boxes of 10,000 nuts there are. Ask, "If we wanted to put this 10 in one of the tally spaces, where would we put it?" But following the principle mentioned in Note 2, we now put it as a "1" in the hundreds' space for the thousands' group.

127

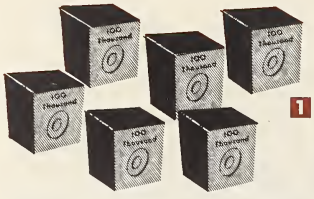
1 Have the children note how many boxes of screws there are of each quantity. Ask, "Should any figures be put in the first three spaces? Should any figures be put in the second group of spaces, the thousands' group?" Discuss the placing of the figures in the spaces and say that we begin reading the number "two hundred thirteen" and then say "thousand" when we are through.

2 Tell the children to read the figures in red just as they would any number; then say "thousand" and finish reading the number.

3 Let the children read these numbers without any help. They should say "thousand" after reading the red figures.

4 If the children have trouble reading these numbers, you can write them on the chalkboard, using a different color for the thousands.

5 Have the class write out these exercises.



hundreds	tens	ones	hundreds	tens	ones	hundreds	tens	ones
			1					

millions thousands

1,000,000
one million D

2 Say million. Say thousand.

A	2,557,628
B	9,346,000
C	36,801,709
D	158,000,000
E	70,400,000
F	5,000,900
G	642,263,080

3 Read.

A	4,750,529
B	27,386,100
C	3,927,004
D	800,130,900
E	55,741,226
F	198,416,003
G	375,800,000

4 Read.

A	82,420,000
B	716,000,500
C	1,585,250
D	397,026,488
E	63,080,700
F	8,000,000
G	657,932,060
H	325,609
I	1,000,231
J	42,001
K	900,030
L	60,110
M	390,001,010
N	65,100,200
O	1,232,847

5 Write with numerals.

A seven million sixty thousand one hundred eight
B twenty million five hundred thousand sixteen
C forty-one million nine thousand two hundred twenty
D three hundred eighty-eight million five hundred
E seven hundred ninety million thirty
F fifty-two million seventy-eight thousand eight
G nine hundred ninety-nine million fifty-six

Now you should be able to read and write numerals that mean thousands or millions.

128

128

1 Let the children observe how many boxes of washers there are. Have them explain why there are no figures in the first two groups of spaces at the right. Discuss the fact that now we are over in the third group of spaces and that we put 1 in the ones' space because we have one million.

2 Explain that we say "million" for the numbers in black, "thousand" for those in red, and read the rest of the number, which is black, as usual. Let the children take turns reading these numbers.

3 Let the children take turns reading these numbers. (The thousands have been printed in red as an aid.)

4 Let the children read these aloud. To test the children's skill, zeros have been put in many different places.

5 Use these exercises as written work.

129 Thinking straight

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns that when he multiplies by zero, or multiplies zero, the answer is zero; that when zero is divided by any number, the answer is zero. He also learns that when he multiplies 1 by a number, or when he multiplies a number by 1, the answer is the number itself. Finally, he learns that when he divides a number by itself, the answer is 1.

Vocabulary

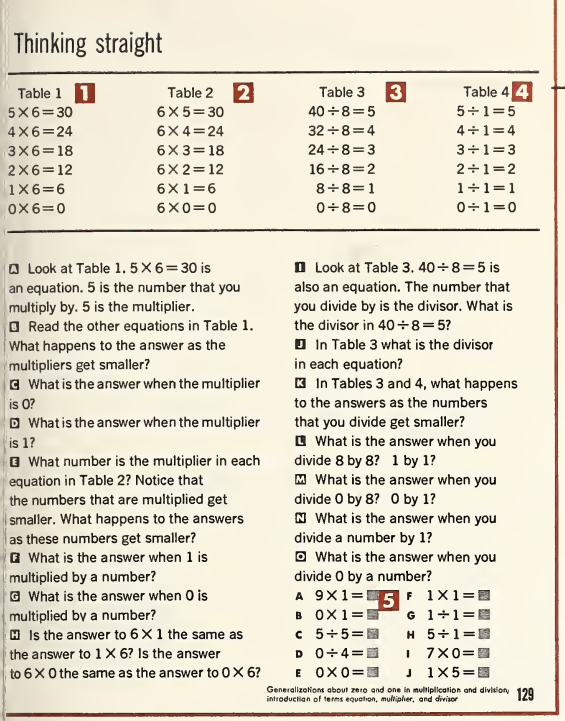
New words page 129 equation, divisor, notice*, happens*

Comments

This lesson is included here so that the child will understand the usual generalizations about zero and one, and be able to answer test questions about zero and one.

Discuss this page at length in class. As the pupils talk about it, help them form the generalizations. When working with Tables 1 to 4, you may wish to supply similar tables on the board to help the class arrive at the generalizations developed in Exercises A to O. This is a good point at which to develop the "tables" for the multiplication and division basic facts. Let each child select a table that he wants to make. Use these tables to assist the children in arriving at generalizations.

The answers to the exercises are obvious; so none are supplied.


Thinking straight
Table 1 1
5×6=30
4×6=24
3×6=18
2×6=12
1×6=6
0×6=0
Table 2 2
6×5=30
6×4=24
6×3=18
6×2=12
6×1=6
6×0=0
Table 3 3
40÷8=5
32÷8=4
24÷8=3
16÷8=2
8÷8=1
0÷8=0
Table 4 4
5÷1=5
4÷1=4
3÷1=3
2÷1=2
1÷1=1
0÷1=0
A Look at Table 1. 5×6=30 is an equation. 5 is the number that you multiply by. 5 is the multiplier.
B Read the other equations in Table 1. What happens to the answer as the multipliers get smaller?
C What is the answer when the multiplier is 0?
D What is the answer when the multiplier is 1?
E What number is the multiplier in each equation in Table 2? Notice that the numbers that are multiplied get smaller. What happens to the answers as these numbers get smaller?
F What is the answer when 1 is multiplied by a number?
G What is the answer when 0 is multiplied by a number?
H Is the answer to 6×1 the same as the answer to 1×6? Is the answer to 6×0 the same as the answer to 0×6?
I Look at Table 3. 40÷8=5 is also an equation. The number that you divide by is the divisor. What is the divisor in 40÷8=5?
J In Table 3 what is the divisor in each equation?
K In Tables 3 and 4, what happens to the answers as the numbers that you divide get smaller?
L What is the answer when you divide 8 by 8? 1 by 1?
M What is the answer when you divide 0 by 8? 0 by 1?
N What is the answer when you divide a number by 1?
O What is the answer when you divide 0 by a number?
5
A 9×1=
B 0×1=
C 5÷5=
D 0÷4=
E 0×0=
F 1×1=
G 1÷1=
H 5÷1=
I 7×0=
J 1×5=
Generalizations about zero and one in multiplication and division, introduction of terms equation, multiplier, and divisor
129

129

1 Have the children examine Table 1 and then discuss it. By using Exercises A to D, let the children discover that as the multiplier becomes smaller, the answers become smaller.

2 Have the children examine Table 2 to see how it differs from Table 1. This time the multipliers are alike, but the numbers multiplied and the answers become smaller.

3 Have the children study Table 3 and discover that here the divisors are the same, but the numbers that are to be divided become smaller, and as they do, the answers are smaller by 1. Use Exercises I to M to assist the children in making generalizations. Pay particular attention to the number divided by itself and to zero as the number divided.

4 Work with Table 4 as you did with Tables 1 to 3 using Exercises K to O.

5 Let the children take turns giving the answers. Then have them make up similar equations to test one another.

130-133 Exploring problems

Expanded Notes for this lesson are on pages 296-297.

Objectives

The child learns to subtract to solve problems in which he must find how many are gone when he knows the number there were to begin with and the number remaining.

Vocabulary

New words page 132 herself*; page 133 folders, wrapped*

Comments

So far in this book eight types of problem situations and methods for solving them have been retaught: (1) basic additive, (2) basic subtractive, (3) multiplicative, (4) divisive (finding the number of equal groups), (5) comparative (finding how many more or fewer than), (6) finding how many more are needed or were added, (7) finding the number of items to begin with when the number of items added and the number of items resulting are known, and (8) partitive division (finding the size of the equal groups).

In this lesson children are introduced to a type of problem situation that has not been encountered before in this program. This is the situation in which they know the number of objects there were to begin with and how many were left. The problem is to find how many were taken away. This is a subtractive situation. Up until now the children have met only one kind of subtractive situation in their problem solving, and that has been the basic subtractive situation in which a known part of a known total group has been removed or has been imagined as being removed. Both the basic subtractive situation and the comparative situation come under this type. The pictures and explanations in this lesson will make it clear to children why they can use subtraction in finding how many are gone.

In the "See" step of the first problem on page 130, the children learn through pictures and text how to make the equation that symbolizes what happened in the

problem situation. The important thing for them to understand in this type of problem is that the screen representing the unknown number (the unknown group that has been removed) is placed immediately at the right of the minus sign.

The "Compute" step shows the children why they can subtract to get the answer. If the children have difficulty with this type of problem, use objects to show by real action just what happens in the problem and what happens in the solution.

Answers

Exploring problems:

In a problem like H an equation like $120-86=\square$ should be accepted if the child can justify it.

A $69¢-[45¢]=24¢$
B $54-[36]=18$
C $41-[9]=32$
D $18-[15]=3$
E $24-[18]=6$
F $30-[16]=14$
G $35-[26]=9$
H $86+[34]=120$
I $[88]+15=103$
J $45-[28]=17$
K $62-[17]=45$
L $\$3.25-\$1.29=[\$1.96]$
M $24-[9]=15$
N $12-[8]=4$

Keeping skillful:

(block 1)

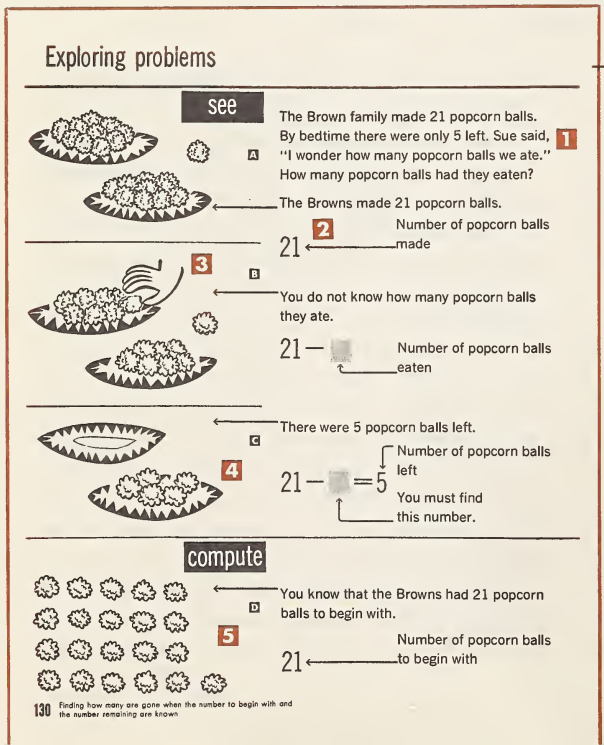
A 49	D 518	G 8	J 2510
B 60	E 228	H 337	K 884
C 49	F 14	I 97	

(block 2)

A 83	D 316	G 119	J 5292
B 643	E 92	H 311	K 1875
C 53	F 1221	I 8	

(block 3)

A 728	D 503	G 448	J 3964
B 152	E 187	H 96	K 4030
C 665	F 367	I 3052	


Exploring problems
see
The Brown family made 21 popcorn balls. By bedtime there were only 5 left. Sue said, "I wonder how many popcorn balls we ate." How many popcorn balls had they eaten?
1
A
The Browns made 21 popcorn balls.
2
Number of popcorn balls made
21
3
B
You do not know how many popcorn balls they ate.
21 − ▢
Number of popcorn balls eaten
There were 5 popcorn balls left.
C
4
21 − ▢ = 5
Number of popcorn balls left
You must find this number.
compute
You know that the Browns had 21 popcorn balls to begin with.
D
5
21
Number of popcorn balls to begin with
130 Finding how many are gone when the number to begin with and the number remaining are known

130

1. Draw attention to Problem A. Then call on someone to relate Picture A to the problem. Make sure the class understands that only the total group is shown in the picture.
2. Explain that this number stands for the popcorn balls that the Browns made.
3. Help the children see that this picture indicates that some of the popcorn balls are being removed but that we do not know how many. Have pupils relate the picture to the equation at the right. Make sure they realize that the minus sign indicates that some popcorn balls are being removed and that the screen indicates that we do not know how many.
4. This picture shows the 5 popcorn balls that were left. Have the children discuss how this is shown in the equation at the right.
5. Tell pupils that here the popcorn balls have been rearranged so that we can easily see how many there were to begin with.

1 Think of a group of popcorn balls equal in number to the popcorn balls left.

Number of popcorn balls left

5

2 Imagine that this group of 5 popcorn balls is gone.

21
5 ← Subtract 5 from 21.
□

21
5
16 ← They had eaten 16.

3 The number left tells how many popcorn balls the Browns had eaten.

4 $21 - \square = 5$

This number is 16. The Browns had eaten 16 popcorn balls.

see

A

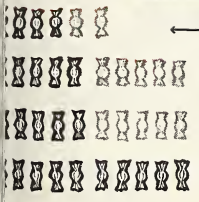
5 Betty had 36 pieces of candy. She gave some of them away. Then she had 12 pieces left. How many pieces did she give away?

What does this number stand for?
What does this stand for?
What does this number stand for?

$36 - \square = 12$

Now turn the page.

compute



B

How many pieces of candy did Betty have at first? Why do you imagine that 12 of them are gone? 1

36
12 ← Why should you subtract 12? 2
□ ← What will this number show?

$36 - \square = 12$ 3

Betty gave away ■ pieces of candy.

A David had 69¢ in the morning. During the day he paid for his lunch at school and bought some pencils. At bedtime he had 24¢ left. How much money had he spent during the day? 4

Number of cents he had to begin with.
Number of cents he spent.
Number of cents he had left.

$69 - \square = 24$ You must find this number.

Subtract 24 from 69.
David spent ■ cents during the day.

B Tony had 54 baseball cards. He gave all but 18 of them away. How many baseball cards did he give away? 5

$54 - \square = 18$ Subtract 18 from 54.

C Jim had a bag with 41 marbles in it. The bag broke, and Jim could find only 32 of the marbles. How many marbles had Jim lost? 5

$41 - \square = 32$ Subtract 32 from 41.

D Mrs. Brown made 18 sandwiches for lunch. After lunch 3 sandwiches were left. How many sandwiches had the Browns eaten? 6

E Mrs. Brown put a plate of 24 cookies on the lunch table. Six cookies were left after lunch. How many cookies had been eaten?

F Mrs. Brown picked 30 flowers. She kept 14 flowers for herself and sent the rest to school. She sent how many flowers to school?

131

1 Point out that the circled group is a group equal to the 5 popcorn balls that were left. Tell pupils that any group of 5 popcorn balls could be circled.

2 Draw attention to the group that is dimmed off, and have pupils note that it is the same group of 5 that was circled above. Help them understand that when we know how many there were in the beginning and how many were left, we can imagine the ones that were left as being removed. Those remaining are the popcorn balls that were eaten. Relate this to the computation at the right.

3 Tell pupils to write the numbers in the form for computation.

4 Draw attention to this equation and have pupils see that 16 does fit this equation because when they subtract, the answer is 5.

5 Have pupils relate this problem to the picture. Have them answer the questions about the equation.

132

1 Have pupils answer these questions by referring to the picture.

2 Call on pupils to answer these questions. Have them relate the computation to the picture.

3 Let pupils discuss this equation and explain how they know the number 24 belongs in it.

4 Have them read this problem and discuss each number in it. Call attention to the statement below the equation in the book that tells them to "subtract 24 from 69" to solve the problem. Explain that they should always *think* this statement, then write the numbers in computational form to get the answer.

5 Proceed in the same way with this problem.

6 Let the children work independently on Problems D to N without prior discussion. Instruct pupils to write the equation with the screen, do the computation, and rewrite the equation with the answer in it.

G Peggy had 35 paper dolls. She gave away all but nine of them. How many paper dolls did she give away?

H Sue has a book about moths and butterflies with 120 pages in it. She has read 86 pages. How many more pages are there for her to read? 1

I Tom has a collection of stamps. Today his brother gave him 15 new stamps. Now he has 103 stamps. Tom had how many stamps to begin with? 1

J One day Carol said that she had 45 tickets to sell for a movie at school. At the end of the day she had 17 tickets left. How many tickets had she sold that day?

K Don had 62 match folders. He kept 45 for himself and gave the rest away. How many match folders did Don give away?

L Bill had $3.25. He spent $1.29 for a flashlight. How much money did he have then? 1

M Betty bought 24 postcards. She kept 15 of them for herself and sent the rest to her friends. She sent how many cards to her friends?

N Nancy bought 12 yards of ribbon. After she had wrapped some packages, she found she had 4 yards of ribbon left. How many yards of ribbon had she used to wrap the packages?

In many of these problems you were finding how many things were gone or lost or eaten. 2

Keeping skillful

A	76 − ■ = 27 3	A	■ + 326 = 409 3	A	958 − 230 = ■ 3
B	200 − ■ = 140	B	68 + 575 = ■	B	601 − 449 = ■
C	91 − ■ = 42	C	84 + ■ = 137	C	743 − 78 = ■
D	603 − ■ = 85	D	390 + ■ = 706	D	560 − 57 = ■
E	499 − ■ = 271	E	■ + 208 = 300	E	900 − 713 = ■
F	52 − ■ = 38	F	791 + 430 = ■	F	826 − 459 = ■
G	67 − ■ = 59	G	■ + 95 = 214	G	514 − 66 = ■
H	500 − ■ = 163	H	■ + 731 = 1042	H	277 − 181 = ■
I	384 − ■ = 287	I	89 + ■ = 97	I	3750 − 698 = ■
J	4228 − ■ = 1718	J	987 + 4305 = ■	J	5040 − 1076 = ■
K	5693 − ■ = 4809	K	6125 + ■ = 8000	K	7925 − 3895 = ■

133

133

1 Be sure pupils see that these problem situations are different from the rest in this problem set and that they show this difference by the equations they make.

2 When pupils have finished solving these problems as written work, discuss the problems that have caused the most trouble. For those problems that caused only minor difficulty or with which only a few children had trouble, let pupils help one another.

3 Assign these exercises as written work. Pupils are to write the numbers in computational form and find the answers.

134-137 Exploring problems

Expanded Notes for this lesson are on pages 297-298.

Objectives

The child learns to add to solve problems in which he must find how many items there were at first when the number gone and the number left are known.

Vocabulary

New words page 134 minnows; page 135 back*; page 136 total, dug*, worms*; page 137 catch*, caught*, knew*, throw*, told*

Comments

In this lesson children are introduced to problems involving another kind of situation and are taught how to solve them. This time they do not know how many objects there were to begin with, but they do know how many were removed and how many are left. The action in this problem situation requires an equation different from those previously met, but still subtractive. However, the process used in solving the problem is addition.

The steps in learning how to handle this type of problem situation are presented in much the same way as those for the how-many-are-gone type of problem studied in the preceding lesson. Pictures help the child see how to build the proper equation—one that has an unknown number, a minus sign, a known number, an equals sign, and a known number, in that order.

To compute with these numbers, children are taught to imagine the group that was taken from the original unknown number as added to the remaining group. Their sum will be the number they are to find—the quantity started with.

In a situation where groups of objects do not actually move together into one group, but in which the sum or product is required, the imagined joining will be indicated by a dotted background (see Picture F on page 135 and Picture B on page 136). This dotted background will be referred to as a "binder" in these lesson briefs. Be sure the children understand that it indicates that they are to think of the groups as combined.

Take care to see that the children really understand this kind of problem, for it is one that has caused them a great deal of trouble under traditional methods of instruction. For a detailed discussion of this type of problem, see the Charting of the Course on pages 295-296 of this *Teaching Guide*.

The "Keeping skillful" exercises provide additional practice in handling the new equation. They also provide practice on subtractive equations and on a mixture of additive and subtractive equations.

Answers

Exploring problems:

A [13]−8=5
B [68¢]−45¢=23¢
C [31]−19=12
D [17]−8=9
E 69¢−45¢=[24¢]
F 26+28=[54] or 28+26=[54]
G [14]−5=9
H 15+18=[33] or 18+15=[33]
I 16−13=[3]; 3 oz. less
J [$17.15]−$4.75=$12.40
K [18]−6=12
L 75¢−53¢=[22¢]

Keeping skillful:

(block 1)

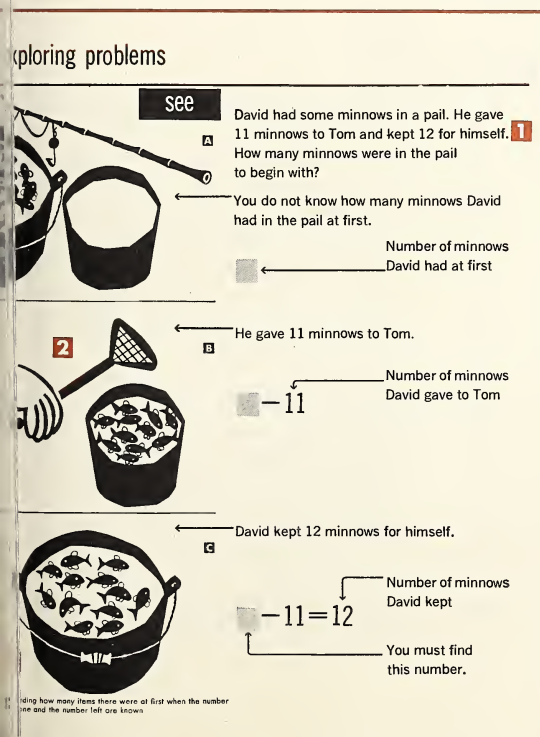
A 63 D 260 G 626
B 226 E 987 H 2683
C 293 F 292

(block 2)

A 27 D 289 G 59
B 73 E 138 H 205
C 139 F 666

(block 3)

A 575 C 739 E 99 G 865
B 486 D 83 F 2115 H 1766


xploring problems
see
A
David had some minnows in a pail. He gave 11 minnows to Tom and kept 12 for himself. 1
How many minnows were in the pail to begin with?
You do not know how many minnows David had in the pail at first.
Number of minnows David had at first
2
B
He gave 11 minnows to Tom.
Number of minnows David gave to Tom
−11
C
David kept 12 minnows for himself.
Number of minnows David kept
−11=12
You must find this number.
ding how many items there were at first when the number ine and the number left are knows

134

1 Have pupils read this problem and relate it to Picture A. They should realize that they cannot tell from the picture how many minnows there were in the pail to begin with. They should understand that this is why the screen comes first in the equation.

2 Explain that Picture B shows that some of the minnows have been taken out of the large pail and put into the smaller pail. Pupils can count how many have been taken from the large pail, and they can read how many. Make sure they observe the subtractive action suggested in the picture. Have them relate the action in the picture to what has been written at the right side of the equation (−11).

3 This picture shows how many minnows David kept for himself, that is, the number left after he gave 11 of them to Tom. Call on someone to explain how the equation shows this.

compute

1

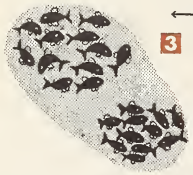
D You know that David kept 12 minnows for himself.

12 ← Number of minnows David kept

2

E You also know that David gave 11 minnows to Tom.

11 ← Number of minnows David gave to Tom



3

F Imagine that the group of 11 minnows is put back with the group of 12 minnows.

12
11 ← Add 11 to 12.

4

12
11
23 ← The sum of 12 and 11 tells how many minnows David had in the pail to begin with. He had 23 minnows.

■ − 11 = 12 ← This number is 23. David had 23 minnows to begin with.

see

A Tom had a box of weights for his fish line. After he had given David 4 of them, he had 18 weights left. How many weights did Tom have to begin with? 1

What does this stand for? What does this number stand for?

■ − 4 = 18 What does this number stand for?

compute

2

B How many weights did Tom have left? How many weights do you imagine as put with these 18 weights?

18
4 ← Why should you add 4?

■ ← What will this number show?

■ − 4 = 18 ← Tom had ■ weights to begin with.

A The boys took sandwiches with them when they went fishing. After they had eaten 8 sandwiches, they had 5 left. How many had they taken with them? 3

Total number of sandwiches. Number of sandwiches eaten.

■ − 8 = 5 ← Number left.

You must find this number.

Add 8 to 5.

B David had some money to spend. After he had paid 45¢ for a new fish pole, he had 23¢ left. How much money did he have to begin with? 4

■ − 45¢ = 23¢ Add 45¢ to 23¢.

C The boys dug some worms to fish with. At the end of the day Tom said, "We used 19 worms, and we have 12 left." How many worms had they dug?

■ − 19 = 12 Add 19 to 12. 4

135

1 Explain that the picture shows the 12 minnows David had left. It is the same situation pictured at the bottom of page 134. Point out that the numeral 12 at the right represents this situation.

2 Point out that this picture shows the other group we know about—the 11 minnows David gave to Tom.

3 Through discussion, help the pupils see that this picture shows the two groups of fishes—the 12 minnows David kept and the 11 he gave away. Explain that if we imagine the 11 minnows that were given away as put back with the 12, we will know how many there were to begin with. Ask what the red dotted background suggests [addition]. Direct attention to the computational form shown at the right. Ask the children to add to find the missing number.

4 Let pupils read and discuss this computation. Then let them test the answer in the equation.

136

1 Discuss the problem in terms of the picture and equation.

2 Let a pupil explain what the blue dotted background behind the group of 18 weights and the group of 4 weights means. Have someone else explain why we should think of these two groups as put together. Call on pupils to answer the questions about the computation. Then let someone test the equation after the answer has been inserted.

3 Use this problem orally. If necessary, reproduce the equation on the board and have the children discuss each number in it and explain what each stands for. Stress the fact that after they have made the equation, they should always think what they should do next with the figures, as, "Add 8 to 5." Then they should write the numbers in computational form and compute.

4 Use the same procedures with this problem.

D Tom's father said, "How many fish did you catch today?" Tom told him, "We had to throw 8 fish back because they were too small. We have 9 fish here." How many fish in all had the boys caught?

E David's new fish pole cost 45¢. Tom's fish pole cost 69¢. Tom's pole cost how much more than David's? 2

F One day the boys dug worms to sell. Tom dug 26 worms, and David dug 28 worms. Together, the boys dug how many worms? 2

G Tom saves big cans to use when he goes fishing. After he had given 5 of his cans to his brother, he had 9 cans left. How many cans did Tom have at first?

H One day Tom's father caught a fish that weighed 15 ounces and another fish that weighed 18 ounces. Together the fish weighed how many ounces? 2

I David caught a turtle that weighed 13 ounces. It weighed how much more than or how much less than 1 pound? 2

J After Tom's father paid $4.75 to use a rowboat, he had $12.40 left. How much money did he have before he paid for the use of the rowboat?

K Nancy bought some minnows when she went fishing. She used 6 of them and took 12 home with her. How many minnows had she bought?

L Nancy had 75¢ to spend. She paid 53¢ for the minnows. How much money did she have left? 2

In many of these problems you knew how many things were taken away and how many were left. Then you found how many things there were to begin with. 3

Keeping skillful

5

A ■ − 39 = 24
B ■ − 76 = 150
C ■ − 205 = 88
D ■ − 91 = 169
E ■ − 437 = 550
F ■ − 84 = 208
G ■ − 152 = 474
H ■ − 600 = 2083

5

A 83 − ■ = 56
B 29 + ■ = 102
C ■ + 75 = 214
D ■ − 75 = 214
E 368 + ■ = 506
F ■ − 229 = 437
G 740 − ■ = 681
H ■ + 198 = 403

5

A 976 − 401 = ■
B 724 − 238 = ■
C 835 − 96 = ■
D 500 − 417 = ■
E 608 − 509 = ■
F 4283 − 2168 = ■
G 1542 − 677 = ■
H 3000 − 1234 = ■

137

137

1 Let the pupils work independently on these problems, without any prior discussion. For each problem they should write the equation with the screen, compute, and rewrite the equation with the answer inserted.

2 This problem has an equation different from the one introduced in this lesson. Be sure the children write the proper one.

3 Provide answers so that the children may verify their work. Then discuss those problems that caused the most trouble.

4 Assign these exercises involving the new equation as written work. Pupils are to write the numbers in computational form and find the answers.

5 Have pupils write the letters A to H on their papers, compute, and write each answer opposite its identifying letter.

138 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child reviews what he has learned about the number system as it relates to multiplication. He also reviews addition and subtraction of two-figure, three-figure, and four-figure numbers.

Vocabulary

There are no new words.

Comments

One of the things in multiplication that is most difficult for the child to comprehend is multiplying a two-figure or three-figure number by a number that ends in one or more zeros. His ability to understand this type of multiplication depends upon his understanding of the number system. Before he is actually taught how to multiply such numbers, he should recall what he has learned about regrouping tens as hundreds and hundreds as thousands, and how to write the resulting number.

The work on this page is based on the lesson on pages 11 to 15. If this page discloses any fundamental lack of understanding of this material on the part of the children, the work on pages 11 to 15 should be retaught.

Note that in Examples A to D at the top of the page the zeros that show the numbers as tens, hundreds, or thousands have been printed in blue. This helps the child see instantly which zeros were annexed and helps him understand how these numbers are written.

Answers

(block 5)

A 234	E 142	I 456	M 273	Q 174
B 107	F 224	J 4147	N 1502	R 890
C 23	G 46	K 92	O 928	
D 688	H 43	L 115	P 195	

Keeping skillful

A 12 tens 120
120 tens 1200

B 4 tens 40
40 tens 400
400 tens 4000

C 6 hundreds 600
60 hundreds 6000
600 hundreds 60000

D 8 thousands 8000
80 thousands 80000
800 thousands 800000

4
A 13 tens = 13—
B 60 tens = 60—
C 14 hundreds = 14—
D 72 hundreds = 72—
E 244 tens = 244—
F 16 thousands = 16—
G 350 hundreds = 350—
H 97 tens = 97—
I 112 thousands = 112—
J 140 tens = 140—
K 25 thousands = 25—
L 86 hundreds = 86—
M 753 thousands = 753—
N 31 tens = 31—
O 11 thousands = 11—
P 380 hundreds = 380—
Q 78 hundreds = 78—
R 490 tens = 490—

5
A 60 tens = ■
B 10 hundreds = ■
C 47 thousands = ■
D 132 hundreds = ■
E 96 tens = ■
F 84 tens = ■
G 110 thousands = ■
H 79 hundreds = ■
I 86 thousands = ■
J 520 hundreds = ■
K 21 thousands = ■
L 90 hundreds = ■
M 17 tens = ■
N 260 thousands = ■
O 790 tens = ■
P 485 hundreds = ■
Q 10 tens = ■
R 38 thousands = ■

5
A 11 hundreds = ■
B 119 thousands = ■
C 44 tens = ■
D 811 tens = ■
E 76 hundreds = ■
F 23 thousands = ■
G 15 hundreds = ■
H 500 thousands = ■
I 99 tens = ■
J 600 tens = ■
K 101 hundreds = ■
L 82 thousands = ■
M 700 thousands = ■
N 100 tens = ■
O 94 hundreds = ■
P 391 tens = ■
Q 460 thousands = ■
R 22 hundreds = ■

6
A ■ − 54 = 180
B 95 + ■ = 202
C 42 − ■ = 19
D ■ + 3315 = 4003
E ■ − 60 = 82
F 86 + 138 = ■
G 110 − ■ = 64
H ■ + 58 = 101
I ■ − 110 = 346
J 2429 + ■ = 6576
K 405 − ■ = 313
L ■ + 77 = 192
M 784 − ■ = 511
N 6905 + ■ = 8407
O 542 + 386 = ■
P 513 − ■ = 318
Q ■ + 226 = 400
R ■ − 300 = 590

138

138

1 Examples A and B show the child how to write a specified number of tens by annexing a zero to the number that tells how many tens. Remind the children that 1 ten is written by putting one zero after 1.

2 The child learns how to write hundreds by putting two zeros after the number that tells how many hundreds.

3 The child learns to write thousands by putting three zeros after the number.

4 Have the children respond orally by saying the number that should come after the equals sign. The wavy line indicates that they are to complete the number. You may also have them write the entire number.

5 Direct the children to write each number.

6 Have the children write the numbers in computational form and compute. Emphasize that they must think about whether they should add or subtract in each of these exercises.

139 Using arithmetic

Exponded Notes are not considered necessary for this lesson.

Objectives

The child practices solving problems of various types taught so far in this book.

Vocabulary

New words page 139 art, people*, heavier*

Comments

Have the children continue to make the proper equation for each problem. The children should work the problems independently first, because such independent work is more interesting for them and also because it provides an accurate way of finding any weaknesses they may have. After they have worked the problems, supply equations and answers to the computation and let them verify their work. Find out which, if any, problems caused a great deal of trouble, and which caused no or only slight trouble. Then devote a few minutes to problems that only one or two children missed. Let the children help each other with these problems. After this, as much time as necessary should be spent discussing any problems that many in the class found difficult.

Answers

A [24] + 7 = 31
B 50¢ − 35¢ = [15¢]
C [53] − 18 = 35
D 15 − 9 = [6]
E $4.27 + $1.49 + $.83 = [$6.59]
F 27 ÷ [9] = 3
G 54 ÷ 6 = [9]
H 120 − [41] = 79
I 72 ÷ [9] = 8
J 22 + [8] = 30
K 55 − 36 = [19]
L [720] − 208 = 512
M 8 × 9¢ = [72¢]

Using arithmetic 1

A Seven girls went into an art store. Mary counted all the people and said, "There are 31 people in here now." How many people were in the store before the 7 girls went in?

B Sue bought a paintbrush that cost 35¢. She gave the clerk a half dollar. How much money should the clerk have given Sue in change?

C There were some jars of blue paint on a shelf. The clerk sold 18 jars. Then 35 jars were left on the shelf. How many jars of blue paint were on the shelf before he sold the 18?

D Mary asked the clerk to weigh 2 packages. The big package weighed 15 ounces, and the small one weighed 9 ounces. How much heavier was the big package than the small one?

E Jane wanted to buy a drawing board that cost $4.27, a box of paints that cost $1.49, and a box of colored chalk that cost 83¢. How much money did she need for these three things?

F The clerk put 27 coloring books on 3 tables. He put the same number of books on each table. How many coloring books did the clerk put on each table?

G At the art store, jars of paste came in boxes of 6. The fourth grade needed 54 jars of paste. They needed how many boxes of paste?

H A clerk had 120 large sheets of red paper to sell. After he had sold some of them, he found he had 79 sheets left. How many sheets had he sold?

I 8 boys bought a box of 72 colored pencils and shared them equally. Each boy got how many pencils?

J Ellen had 22 pieces of colored chalk. She bought some more, and then she had 30 pieces of chalk. How many pieces did she buy?

K Peggy bought a spool of red ribbon with 55 feet of ribbon on it and a spool of blue ribbon with 36 feet on it. She bought how much more red ribbon than blue ribbon?

L The clerk said, "I sold 208 pencils today. Now I have 512 pencils left." How many pencils did the clerk have to begin with?

M Carol bought 8 colored pencils for 9¢ apiece. How much did she pay for the 8 pencils? 2

139

139

1 Have the children work Problems A to M independently, without any previous discussion. They should write an equation for each problem, do the computation, and rewrite the equation with the missing number.

2 Supply equations and answers for these problems. Have the children verify their work, and discuss any problems that caused trouble.

140-141 Moving forward

Expanded Notes for this lesson are on pages 299-300.

Objectives

The child learns to multiply when one number has only one figure and the other number has two or three figures, all but one of which are zeros.

Vocabulary

There are no new words.

Comments

This lesson does not deal with computational multiplication in the sense that the child is multiplying a two-figure or three-figure number like 13, 42, or 119 by a one-figure number. His work here is confined to multiplying two-figure and three-figure numbers like 20, 70, or 500 by one-figure numbers. He is still using the multiplication basic facts and annexing the proper number of zeros to the product.

In the preceding "Keeping skillful" exercise, the child learned that multiplying by 10, 100, or 1000 becomes a simple matter of annexing zeros. Now he learns to multiply by any number ending in one or more zeros.

In a future lesson, the child will be multiplying two-figure numbers by two-figure numbers, and he must understand that although the number in tens' place in the multiplier may not be followed by a zero, he still must think of it as tens. For example, when he multiplies 25 by 24, he multiplies first by 4, and gets 100, and then by 2 and gets 50, but he must know that the 2 represents 2 tens, or 20, and the 50 is really 50 tens or 500. The work he does in this lesson will prepare him for this kind of multiplication and will help him understand it.

This lesson also shows that the product is the same no matter which order of factors is used. This is preparation for the suggestion that will be given in a later lesson that no matter how the problem is stated, when the child computes he can multiply by the more convenient number. For example, in a problem for which the equation is $20 \times 4 = \square$, he will find the computation easier if he multiplies 20 by 4.

Answers

Page 141:

(block 1)

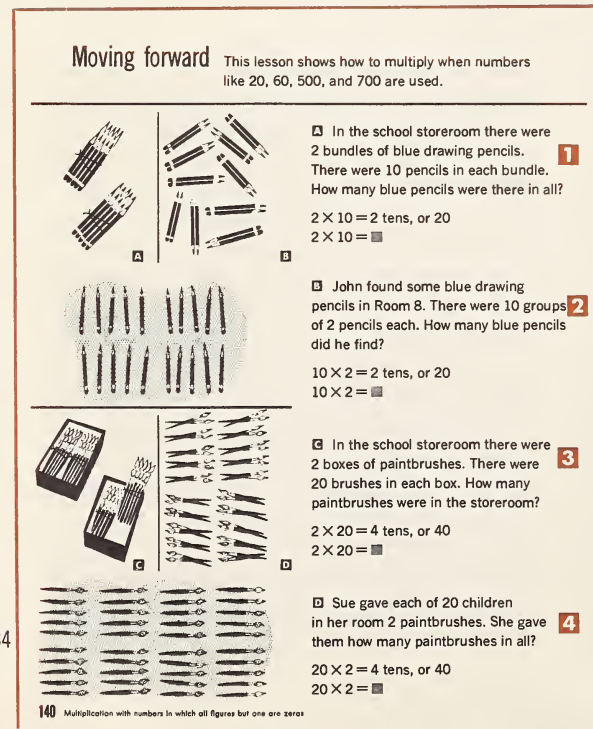
A 30 tens, or 300
B 12 tens, or 120
C 21 hundreds, or 2100
D 20 hundreds, or 2000

(block 2)

A 50
B 600
C 1800
D 90
E 3600
F 280
G 350
H 1000
I 1200

(block 3)

A 1800
B 720
C 70
D 800
E 1400
F 320
G 180
H 250
I 2700
J 490
K 3000
L 900
M 360
N 480
O 1600
P 30
Q 5400
R 3500


Moving forward
This lesson shows how to multiply when numbers like 20, 60, 500, and 700 are used.
A In the school storeroom there were 2 bundles of blue drawing pencils. There were 10 pencils in each bundle. How many blue pencils were there in all?
1
2 × 10 = 2 tens, or 20
2 × 10 = ■
B John found some blue drawing pencils in Room 8. There were 10 groups of 2 pencils each. How many blue pencils did he find?
2
10 × 2 = 2 tens, or 20
10 × 2 = ■
C In the school storeroom there were 2 boxes of paintbrushes. There were 20 brushes in each box. How many paintbrushes were in the storeroom?
3
2 × 20 = 4 tens, or 40
2 × 20 = ■
D Sue gave each of 20 children in her room 2 paintbrushes. She gave them how many paintbrushes in all?
4
20 × 2 = 4 tens, or 40
20 × 2 = ■
140 Multiplication with numbers in which all figures but one are zeros

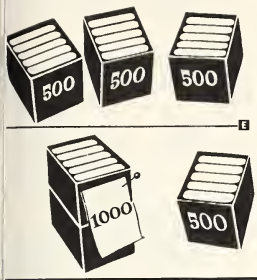
140

1 Ask the children to read Problem A. Tell them to look at the first scene of Movie A and note how it illustrates the problem. Get the children to see the pencils arranged below as 2 groups of 10, or 20. Have them read the equation and relate it to the movie.

2 Ask the children to read Problem B and look at the first scene in Movie B. They should realize that the grouping as 10 groups of 2 is different from the first scene in Movie A, but that these pencils can also be arranged as shown below. Point out that 10 twos means the same total number as 2 tens.

3 In Problem C and Movie C the pupils deal with 2 groups of 20. The scene below helps them see each 20 as 2 tens, and 2 twenties as 4 tens.

4 Use the above techniques with Problem D and Movie D to get the children to see 20 twos. Have them notice that these can be arranged as in the scene below.



E There were 3 boxes of paste sticks on a shelf. There were 500 paste sticks in each box. How many paste sticks were on the shelf?

3 × 500 = 15 hundreds, or 1500
3 × 500 = ■ 1

F If there were 500 groups of 3 paste sticks each on the shelf, how many paste sticks in all would there be on the shelf?

500 × 3 = 15 hundreds, or ■
500 × 3 = ■

A 5 × 60 = ■ tens, or ■ 2
60 × 5 = ■ tens, or ■

B 4 × 30 = ■ tens, or ■
30 × 4 = ■ tens, or ■

C 7 × 300 = ■ hundreds, or ■
300 × 7 = ■ hundreds, or ■

D 5 × 400 = ■ hundreds, or ■
400 × 5 = ■ hundreds, or ■

			4		
A	5 × 10 = ■	10 × 5 = ■	A	6 × 300 = ■	J	7 × 70 = ■
B	2 × 300 = ■	300 × 2 = ■	B	9 × 80 = ■	K	5 × 600 = ■
C	2 × 900 = ■	900 × 2 = ■	C	10 × 7 = ■	L	300 × 3 = ■
D	3 × 30 = ■	30 × 3 = ■	D	2 × 400 = ■	M	4 × 90 = ■
E	6 × 600 = ■	600 × 6 = ■	E	700 × 2 = ■	N	8 × 60 = ■
F	4 × 70 = ■	70 × 4 = ■	F	8 × 40 = ■	O	400 × 4 = ■
G	7 × 50 = ■	50 × 7 = ■	G	20 × 9 = ■	P	10 × 3 = ■
H	5 × 200 = ■	200 × 5 = ■	H	50 × 5 = ■	Q	6 × 900 = ■
I	3 × 400 = ■	400 × 3 = ■	I	900 × 3 = ■	R	700 × 5 = ■

Now you should be able to multiply, using a number like 20, 40, or 300.

141

141

1 Even though these problems deal with hundreds instead of tens, the children should understand that the same principles are applied. In Problems E and F use the movie to get the children to see that in both cases the total is 1500.

2 Be sure children understand that when they say 5 × 60, they think first of 30 tens, or 300, because the six in 60 means 6 tens. Point out that the answer for 60 × 5 is also 30 tens, or 300. Proceed in this way with Exercises B, C, and D.

3 In this set of exercises the children receive additional practice in reversing the factors and in multiplying with numbers that are multiples of 10 or 100. In Exercise A they should think: "5 × 1 = 5. This is really 5 tens, and 5 tens is 50." They should think through similar steps in the other exercises.

4 These exercises may be used either orally or for written work, or both.

142-146 Learning how

Expanded Notes for this lesson are on pages 300-301.

Objectives

The child learns to multiply any two-figure number by a one-figure number.

Vocabulary

New words page 142 buttons*, promised*, hobby; page 143 aside; page 145 instead*

Comments

The child now applies previously learned knowledge to the multiplication process. He has learned the multiplication basic facts; he has used his knowledge of the number system in connection with multiplication both in the multiplication of numbers ending in zeros and in regrouping as a preparation for "carrying" (page 13); and he has had experience in regrouping as used in carrying. All that is necessary now is that he learn to use these together. Careful use of the pictures with the text will help him understand how this is done.

One thing to watch for in multiplication is the possibility that the child may add the carried number before he multiplies. This mistake may arise because in addition he learned that he can add the carried number immediately. However, careful teaching of multiplication with carrying will avoid this difficulty, and it should not be suggested to the child by warning him against it.

You will recall that the process of addition was introduced with carrying and the process of subtraction with borrowing. Similarly, the process of multiplication is introduced with carrying. In this way the child gets a picture of the process as a whole and sees immediately the relations between the columns. This makes it possible to teach multiplication in one series of lessons rather than in several. This is helpful to both you and the child. It does not give the child a partial or oversimplified idea of the process, and it enables you to use whatever practice material you wish, without checking to see that it does not include untaught skills. The four-step teaching method, which was described in connec-

tion with similar treatments, is again used, and the same pictorial devices are used.

Answers

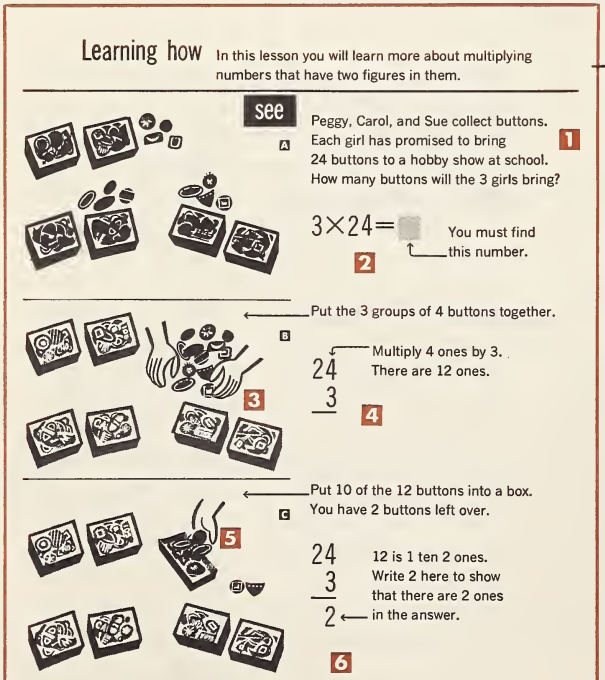
Page 146:

(block 1)

A 192	F 155	K 90	P 414
B 112	G 432	L 105	Q 108
C 60	H 198	M 246	R 166
D 84	I 260	N 315	S 91
E 282	J 129	O 576	T 208

(block 2)

A 702	E 159	I 140	M 210
B 80	F 133	J 272	N 235
C 426	G 178	K 441	O 154
D 188	H 220	L 234	P 168


Learning how
In this lesson you will learn more about multiplying numbers that have two figures in them.
see
A
Peggy, Carol, and Sue collect buttons. Each girl has promised to bring 24 buttons to a hobby show at school. How many buttons will the 3 girls bring?
1
3×24=
You must find this number.
2
Put the 3 groups of 4 buttons together.
B
3
Multiply 4 ones by 3. There are 12 ones.
24
3
4
Put 10 of the 12 buttons into a box. You have 2 buttons left over.
C
5
24
3
2
12 is 1 ten 2 ones. Write 2 here to show that there are 2 ones in the answer.
6
142 Multiplication of 2-figure numbers with carrying (1-figure multiplier)

142

1 Direct the children to read Problem A and re late it to the picture. They should find th groups of buttons.

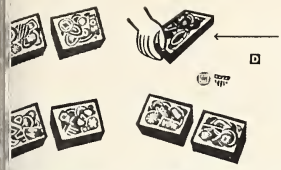
2 Have the children look at the equation and ex plain it in terms of the picture and problem

3 Get the children to observe that first the work with the ones, putting them into on group. They should see that when the one are combined, there are 12.

4 Direct attention to the computation. Be sur the children know they are first going to op erate with the ones (in black). They should know that 4 is the size of each group and the number of groups. Have them relate the multiplication to the picture.

5 They should observe that 10 of the 12 button are being put into the blue box. There are 2 buttons left over.

6 Relate the 2 in the answer to the 2 button left over.



Put the new box of 10 buttons aside.

D

24
3
2

Remember that you have another ten.

Now put the 3 groups of 20 buttons together.

E

Multiply 20, or 2 tens, by 3. There are 6 tens.

24
3
2

Put the new box of ten with the 6 boxes of ten.

F

24
3
72

You had 1 ten to remember. Now add it to the 6 tens. There are 7 tens in all. 4

Write 7 here to show there are 7 tens in the answer.

G

The girls will bring 72 buttons to the hobby show.

$3 \times 24 = 72$

143

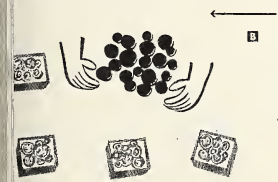
think

A

Four boys will bring coins to the hobby show. Each boy will bring 15 coins. How many coins will the boys bring in all? 1

$4 \times 15 = \square$

You must find this number.



B

What do you put together first?

What do you multiply first?

How many ones are there?

15
4 2

C

How many new boxes of 10 coins can you make? Will any coins be left over? 3

15
4

20 is ▩ tens.

0 Why do you write 0 here?

4

143

1 The children should observe that the new group of 10 buttons is being put aside. Point out that the new ten must be remembered in the computation.

2 Point out that three groups of buttons are being put together and that there are 20 buttons in each group. In the computation they know that $3 \times 2 = 6$, and that this means 6 tens, or 60, because they are really multiplying 2 tens instead of just 2.

3 Get them to notice that the new box of 10 buttons is being put with the 6 boxes of ten.

4 When the remembered 10 is added to the 6 tens, there are 7 tens, or 70. Relate the picture to the computation.

5 Have the children note that this picture shows 72 buttons. Relate it to the equation at the right. Let them explain the numbers in the equation. Relate the picture and equation to the original equation and problem.

144

1 This problem begins the second step of the four-step teaching method, in which the child must answer questions. Have pupils read the problem and relate it to the picture, then examine the equation and explain what each number in it stands for in the picture and in the problem.

2 Relate the figures in the ones' column to what is happening in the picture. Let the children answer and discuss the questions.

3 Have the children answer the questions and relate them to the picture.

4 Direct attention to the computation. Be sure they understand why zero is put in the answer.

D

1

What do you do with the 2 new boxes of 10 coins?

What must you remember?

$$\begin{array}{r} 15 \\ 4 \\ \hline 0 \end{array}$$

E

2

Now what do you put together?

Now what do you multiply? How many tens are there?

$$\begin{array}{r} 15 \\ 4 \\ \hline 0 \end{array}$$

F

3

What do you do with the 2 new boxes of ten?

$$\begin{array}{r} 15 \\ 4 \\ \hline 60 \end{array}$$

Why do you write 6 here instead of 4?

G

4

The boys will bring ■ coins to the hobby show.

$4 \times 15 = ■$

145

145

1 Ask the children to tell what is happening in the picture and to answer the question next to the computation. They should understand that they must remember 2 tens, not just 2.

2 Relate the 1 and 4 in the computation to the picture and have the children multiply the tens. Be sure they understand that the 1 in 15 means 1 ten.

3 Relate the picture to the computation. Pupils must realize that the 6 is 6 tens.

4 Tell the children to read the statement at the right of the picture and say the number that belongs where the screen is, then read and complete the equation. Have them relate the statement and equation to the original problem and the equation in Picture A.

try

A Sixteen boys have promised to bring model airplanes to the hobby show. Each boy will bring 3 airplanes. How many airplanes will the boys bring?

1

$16 \times 3 = ■$

$$\begin{array}{r} 16 \\ 3 \\ \hline 48 \end{array}$$

Multiply by the smaller number.

B $7 \times 31 = ■$

C $9 \times 56 = ■$

D $27 \times 3 = ■$

2

$$\begin{array}{r} 31 \\ 7 \\ \hline 217 \end{array}$$

Why does this answer have three figures?

$$\begin{array}{r} 56 \\ 9 \\ \hline 504 \end{array}$$

$$\begin{array}{r} 27 \\ 3 \\ \hline 81 \end{array}$$

do

3

A Dick will bring 2 stamp books to the hobby show. Each book has 96 stamps in it. How many stamps in all will he bring to the show?

$2 \times 96 = ■$

B Each of 14 girls will bring 8 china animals to the show. The girls will bring how many china animals in all?

$14 \times 8 = ■$

C Five boys will bring pictures that they have taken with their cameras. Each boy will bring 12 pictures. They will bring how many pictures in all?

$5 \times 12 = ■$

D Each of 21 girls has promised to bring 4 dolls to the show. How many dolls have the girls promised to bring?

$21 \times 4 = ■$

4

E	$6 \times 47 = ■$	M	$6 \times 41 = ■$	A	$9 \times 78 = ■$	I	$28 \times 5 = ■$
F	$5 \times 31 = ■$	N	$9 \times 35 = ■$	B	$5 \times 16 = ■$	J	$8 \times 34 = ■$
G	$54 \times 8 = ■$	O	$8 \times 72 = ■$	C	$71 \times 6 = ■$	K	$9 \times 49 = ■$
H	$2 \times 99 = ■$	P	$69 \times 6 = ■$	D	$2 \times 94 = ■$	L	$3 \times 78 = ■$
I	$65 \times 4 = ■$	Q	$4 \times 27 = ■$	E	$53 \times 3 = ■$	M	$6 \times 35 = ■$
J	$43 \times 3 = ■$	R	$83 \times 2 = ■$	F	$7 \times 19 = ■$	N	$47 \times 5 = ■$
K	$5 \times 18 = ■$	S	$7 \times 13 = ■$	G	$2 \times 89 = ■$	O	$7 \times 22 = ■$
L	$15 \times 7 = ■$	T	$52 \times 4 = ■$	H	$4 \times 55 = ■$	P	$56 \times 3 = ■$

Now you should be able to multiply any two-figure number by any one-figure number.

146

1 Tell the children to read the problem, think about the equation, and do the computation. They should then compare their work with the computation shown at the right. Discuss the idea that they can multiply by the more convenient number. In making the equation they should put the multiplier at the left of the multiplication sign.

2 Ask them to work Examples B, C, and D and then compare their work with the computation shown in the book. If they understand what they are doing, they should go ahead with the practice at the bottom of the page.

3 Tell the children to work Exercises A to T in the usual way, writing the numbers in computational form and finding the answers.

4 These examples are for children who need additional practice.

147-153 Learning how

Expanded Notes for this lesson ore on pages 301-302.

Objectives
The child learns how to multiply any three-figure number by a one-figure number.

Vocabulary
New words page 147 puppet; page 150 every*, orders*; page 153 those*

Comments
There is nothing fundamentally new in this lesson. All the child does is apply to three-figure numbers what he has learned to do in multiplying two-figure numbers (pages 142-146). He should be familiar by now with the four-step teaching method used here.

The important thing for the child to keep in mind is that he must always set aside the carried number and add it after he has multiplied in the column to which it is being carried. Children will not be confused between the carrying operation in addition (which permits adding the carried amount immediately) and multiplication (where the carried number is held over) if they understand the process. If a child is confused, he needs careful reteaching with the aid of pictures, such as in this treatment.

As is usual with the four-step teaching method, that part of the illustration not under discussion is dimmed off. In the computational material, the numerals under discussion are in black.

Answers

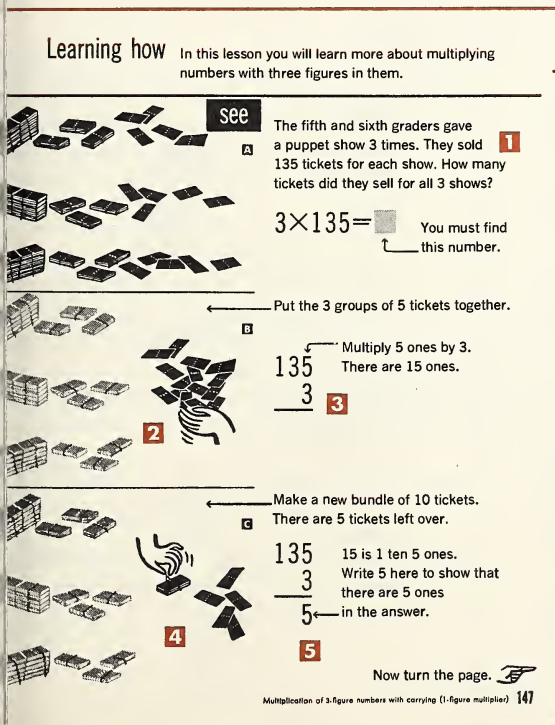
Page 153:

(block 1)

A 625	I 6360	Q 2600
B 1375	J 3324	R 894
C 656	K 2005	S 4085
D 1440	L 4123	T 660
E 1530	M 1860	
F 2736	N 1648	
G 2219	O 532	
H 486	P 2772	

(block 2)

A 749	I 996
B 926	J 5070
C 1944	K 3456
D 744	L 618
E 2720	M 805
F 1410	N 1620
G 3724	O 2690
H 3640	P 819


Learning how
In this lesson you will learn more about multiplying numbers with three figures in them.
see
A
The fifth and sixth graders gave a puppet show 3 times. They sold 135 tickets for each show. How many tickets did they sell for all 3 shows?
1
3×135=
You must find this number.
Put the 3 groups of 5 tickets together.
B
Multiply 5 ones by 3. There are 15 ones.
135
3
3
2
Make a new bundle of 10 tickets. There are 5 tickets left over.
C
135
3
5
15 is 1 ten 5 ones. Write 5 here to show that there are 5 ones in the answer.
4
5
Now turn the page.
Multiplication of 3-figure numbers with carrying (1-figure multiplier) 147

147

1 Have the children read the problem and then relate it to the picture, observing the three groups of 135 tickets. The problem should next be related to the equation.

2 Direct the children to observe that the ones are being put together first.

3 Make sure the children observe that they are going to multiply the 5 (which represents the ones) by 3 so that they will know how many ones there are in all.

4 Let the children see that a new bundle of 10 tickets is being made from the ones that were put together and that there are 5 tickets left over.

5 Draw attention to the 5 in the answer, and tell the children that they had 15 when they multiplied, or a new ten and 5 ones. Explain that 5 is written in the ones' column to show that there are 5 ones.

Put the new bundle of 10 tickets aside. D

135
3
5

Remember this new ten. 2

Now put the 3 groups of 30 tickets together. E

135
3
5

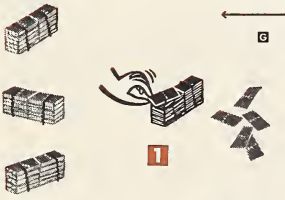
Multiply 30, or 3 tens, by 3. There are 9 tens. 4

Put the new bundle of ten with the 9 bundles of ten. F

135
3
5

Remember to add the new ten to the 9 tens. Now there are 10 tens.

148



Make a new pile of 100 tickets. There are no bundles of ten left. Put the new pile of 100 tickets aside. G

135
3
05

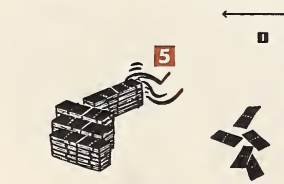
10 tens equal 1 hundred. Remember that you have a new hundred. 2

Write 0 here to show there are no tens in the answer.

Put the 3 old piles of 100 tickets together. H

135
3
05

Multiply 100 by 3. There are 3 hundreds. 4



Put the new pile of 100 with the other hundreds. I

135
3
405

Remember to add the new hundred. Now there are 4 hundreds.

Write 4 here to show there are 4 hundreds in the answer. 6

The children sold 405 tickets.
3 × 135 = 405

149

148

1 Have the children observe that the new bundl of 10 tickets is being set aside.

2 Discuss the fact that they must remember tha they have another ten.

3 Let the children observe that three groups o 30 tickets each are being put together.

4 Draw attention to the numeral the arrow i pointing to and have the children relate wha is being done here (the multiplying of the in 135) with what they saw in the picture. Re mind them that the 3 in 135 means 3 tens, o 30, and that when 3 tens are multiplied by 3 there are 9 tens, or 90.

5 Have the children observe that now the bundl of tens that was set aside in Picture D is bein put with the remaining bundles of ten.

149

1 Tell the children to observe that a new pil of 100 tickets has been made from the 10 bun dles of ten tickets; that it has been set asid temporarily; and that there are no bundles o ten left.

2 Let the class recall that they had 1 ten to re member and see that when they add it to th 9 tens, they have 10 tens. Be sure they thin of this 10 tens as a new hundred to remembe

3 Have the class observe that the 3 hundred are being put together.

4 Remind the class that 3 equal groups can b put together by multiplying by 3. Have a pup read the text aloud.

5 The class should see that the bundle of 10 which was put aside is being put with the hundreds.

6 Help the class see that the remembered 100 added to the 3 hundreds and that the 4 in th answer means 4 hundreds.

think

A

Every day Mrs. Page orders 240 rolls for the school lunchroom. How many rolls does she order in 5 days?

1

$5 \times 240 = \square$ ← You must find this number.

B

← Are there any single rolls to put together?

2

$$\begin{array}{r} 240 \\ \times\ 5 \\ \hline 0 \end{array}$$

← Why should you write 0 here?

3

150

1 Have the children relate the problem to the picture first and then to the equation.

2 Let the class observe that there are no single rolls to be put together; so nothing is done with single rolls.

3 Be sure that the children understand that zero is written in the answer because there are no ones.

← What do you put together first?

C

← How many tens are there after you multiply?

$$\begin{array}{r} 240 \\ \times\ 5 \\ \hline 0 \end{array}$$

2

1

← How many boxes of 100 rolls do you make from the 20 bags of 10 rolls? Are any bags of 10 rolls left over?

D

3

20 tens equal ▩ hundreds.

$$\begin{array}{r} 240 \\ \times\ 5 \\ \hline 00 \end{array}$$

4

← Why should you write 0 here?

Now turn the page.

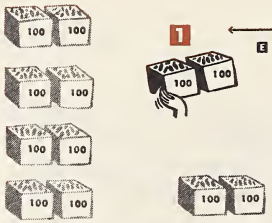
151

1 Have the children observe that the 5 groups of 4 packages of rolls are being put together and that each package contains 10 rolls. They should think of this as 5 groups of 4 tens, or 5 forties.

2 Have the class notice that they are going to multiply the 4 in 240 by 5. Be sure they know that the 4 means 4 tens, and that they will have 20 tens when they multiply.

3 Let the children see that these 20 tens are being put into boxes of 100 and that there are 2 of these boxes.

4 The children should note in the computation that when they multiplied 4 tens by 5 and got 20 tens, this was the same as 2 hundreds. As a result there are no tens in the answer and a zero is written there to show this.



1 What do you do with the 2 new boxes of 100 rolls? E

240 × 5 = 00 — How many hundreds must you remember?

Now what do you put together? F

2

240 × 5 = 00 3 — What do you multiply now? How many hundreds are there when you multiply?

What do you do with the 2 new boxes of 100? G

4

240 × 5 = 1200 5 — Why do you write 12 here instead of 10?

Mrs. Page orders ■ rolls in 5 days.

5 × 240 = ■

152

1 Have the children observe that the 2 new boxes of 100 rolls are being put aside. Remind them that in the computation they must now remember that they have 2 new hundreds.

2 Let the class observe that the 5 groups of 200 rolls are being combined.

3 Be sure the children realize that when they multiply the 2 in 240 by 5 and get 10, this 10 means 10 *hundreds*.

4 Point out that now the 2 new boxes of 100 rolls, which were set aside, are being put with the other 10 boxes of 100.

5 Let the children relate what happens in the computation to what they see in the picture. Help the children discover that the 12 hundreds are also 1 thousand and 2 hundreds.

try

1 A Mrs. Page said that about 320 children ate in the school lunchroom every day for the first three days of this week. About how many children in all ate in the lunchroom on those three days?

3 × 320 = ■

320 × 3 = 960

B 6 × 539 = ■

C 4 × 402 = ■

D 608 × 7 = ■

2

539 × 6 = 3234

402 × 4 = 1608 — Why is 0 written here?

608 × 7 = 4256 — Why is 5 written here?

do

A Every day Mrs. Page orders 125 ice-cream bars. How many does she order in 5 days?

3 5 × 125 = ■

B At Field School the children use about 275 library books every day. About how many library books do they use in 5 days?

5 × 275 = ■

C Each of three hundred twenty-eight children promised to bring 2 books to school for the Junior Red Cross. How many books in all was this?

328 × 2 = ■

D Field School has 180 days of school each year. How many days of school does Field School have in 8 years?

8 × 180 = ■

3

E 3 × 510 = ■
F 684 × 4 = ■
G 317 × 7 = ■
H 3 × 162 = ■
I 8 × 795 = ■
J 6 × 554 = ■
K 401 × 5 = ■
L 7 × 589 = ■
M 2 × 930 = ■
N 206 × 8 = ■
O 133 × 4 = ■
P 9 × 308 = ■
Q 650 × 4 = ■
R 6 × 149 = ■
S 5 × 817 = ■
T 220 × 3 = ■

4

A 7 × 107 = ■
B 463 × 2 = ■
C 9 × 216 = ■
D 6 × 124 = ■
E 340 × 8 = ■
F 2 × 705 = ■
G 4 × 931 = ■
H 7 × 520 = ■
I 332 × 3 = ■
J 6 × 845 = ■
K 432 × 8 = ■
L 309 × 2 = ■
M 115 × 7 = ■
N 180 × 9 = ■
O 5 × 538 = ■
P 273 × 3 = ■

Now you should be able to multiply any three-figure number by any one-figure number.

153

1 Have the children read the problem, note the equation, do the computation, and then compare their work with that at the right.

2 Tell the children to work these examples independently, and then compare their work with that in the book.

3 Have the class work Problems A to D first; then direct them to work Exercises E to T by writing the numbers in computational form and finding the answers. Children should be told to multiply by the smaller of the two numbers, no matter where it comes in the equation.

4 These exercises are for those who can profit from more practice.

154-156 Learning how

Expanded Notes for this lesson are on pages 302-303.

Objectives

The child learns to multiply numbers that represent dollars and cents.

Vocabulary

New words page 155 bats

Comments

Children should be ready to accept the fact that when they multiply numbers that represent dollars and cents, they do it in exactly the same way in which they multiply numbers that represent oranges, cats, or candy. They have already learned why they use the dollar sign and point in computation. Now they learn to use these symbols in multiplication.

In multiplying numbers that represent cents (amounts of money less than one dollar), the children may proceed in two ways. They may prefer to use the cents' sign until they have completed the multiplication and then, if the answer is more than one dollar, rewrite their answer, using the dollar sign and point. For example, they may do the computation in this way: $6 \times 45¢ = 270¢$; they would then write the answer as $2.70. Or they may start with the dollar sign and point immediately in this way: $6 \times \$.45 = \$2.70$. If the children use the cents' sign, they should not be confused if their answer has three figures in it; they should realize immediately, for example, that 178 cents is equal to $1.78.

The four-step teaching method is used here. In the first step (SEE), the multiplication of numbers standing for money is pictured and explained. In this step there are two treatments using the same amounts: the first, as a simple multiplication example so that the child will understand that he uses the same process he already knows; the second, with the dollar sign and point in their correct positions. In the second step (THINK), questions are asked about a solution that is given to a problem. In the third step (TRY), the children can test their ability to multiply with money, since solutions with answers are given for checking purposes. In the fourth step (DO), practice is provided with no further help. Extra exercises are provided (A to P) for those who need more practice.

Answers

Learning how:

(block 1)

A $1.92	J $3.60
B $1.80	K $4.50
C $21.77	L $18.81
D $2.76	M $2.36
E $1.62	N $6.32
F $6.95	O $4.34
G $8.80	P $11.28
H $15.00	Q $17.36
I $4.56	R $15.63

(block 2)

A $3.92	I $.81
B $25.50	J $12.69
C $1.70	K $5.60
D $9.24	L $32.40
E $5.67	M $1.58
F $3.08	N $1.44
G $1.70	O $11.25
H $37.10	P $20.08

Keeping skillful:

(block 1)

A 114	E 239	I 79	M 567
B 1514	F 1751	J 724	N 1740
C 881	G 1068	K 1077	O 1265
D 1399	H 230	L 1619	P 354

(block 2)

A 351	I 532	A 258	I 7200
B 68	J 144	B 4500	J 165
C 472	K 528	C 518	K 522
D 687	L 1446	D 1884	L 711
E 265	M 27	E 430	M 2150
F 1172	N 488	F 1436	N 90
G 3686	O 2331	G 384	O 984
H 779	P 341	H 560	P 133

(block 3)

Learning how

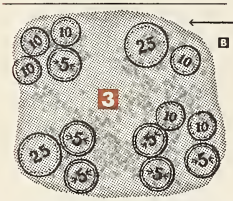
In this lesson you will learn how to multiply numbers that mean dollars and cents.

see

A

Betty earns 35¢ a week by helping her mother wash dishes. How much money does she earn in 4 weeks? 1

$4 \times 35¢ = \square$ 2 — You must find this number.



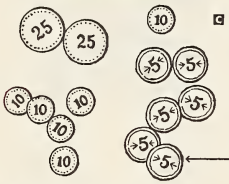
B

Imagine that the 4 groups of 35¢ are put together.

4

35
4
140

Multiply just as you do with any numbers. When you multiply 35 by 4, the answer is 140. You know that this 140 means 140 cents, or 1 dollar and 40 cents.



C

When you multiply an amount of money, write the amount with a point and dollar sign.

$ .35
4 5
$1.40

Remember to put a point and dollar sign in the answer.

Betty earns $1.40 in 4 weeks.
$4 \times \$.35 = \$1.40$

think

A

John is earning money to buy 3 model trucks. The trucks cost 89¢ apiece. How much money does John need to buy these trucks? 1

$3 \times \$.89 = \square$ — You must find this number.

2 — There are ■ groups of ■¢ each.

$ .89
3 — Why is no point or dollar sign written here? 3
$2.67 — What must you remember to write in the answer?

John needs how much money?
$3 \times \$.89 = \square$

try

A David's father bought 2 baseball bats for the boys. The bats cost $1.65 each. The bats cost how much in all?
4 $2 \times \$1.65 = \square$

$1.65
2
$3.30

B Mrs. Brown bought 3 books to give to Sue on her birthday. The books cost $1.75 each. How much did the 3 books cost?
$3 \times \$1.75 = \square$

$1.75
3
$5.25

C $5 \times \$2.37 = \square$

$ 2.37
5
$11.85 ← Why does this answer have 4 figures?

D $8 \times \$.73 = \square$

$ .73
8
$5.84

E $6 \times \$4.05 = \square$

$ 4.05
6
$24.30

154

1 After Problem A has been read, have pupils look at Picture A and find the four groups of coins, each equaling 35¢. Call on a pupil to count the amount in each group of coins.

2 Ask a pupil to relate this equation to the problem and the picture. Be sure he can explain that 4 is the number of groups of money and that 35¢ is the amount in each group.

3 Pupils should remember that a dotted background suggests that the groups are to be thought of as combined.

4 Have pupils look at this computation. Be sure they understand they multiply just as they do with any numbers. Get someone to explain why 140 cents is the same as $1.40.

5 Explain why the dollar sign and point have been used here. Let pupils discover that the coins have been rearranged for counting so they can verify the answer.

155

1 Have pupils read this problem and relate the equation to it.

2 Let a pupil explain the three groups of coins, counting them to show that each group does equal 89¢. Have him tell what the dotted background means and why the groups should be thought of as combined.

3 Call on pupils to fill in the missing numbers and to answer the questions. Be sure the class multiplies to verify the answer.

4 Assign these two problems and the three examples that follow as written work. Tell pupils to multiply and then compare their work with that shown in the book. Tell pupils that if they understand these examples to go right on to the DO step on page 156.

do

A Betty bought 4 dozen oranges. The oranges cost $.48 a dozen. How much did all of the oranges cost?
4 × $.48 = ■

B Each of 6 children paid 30¢ to go to a movie. How much did the children pay altogether to go to the movie?
6 × $.30 = ■

1

7 × $3.11 = ■	K	5 × $.90 = ■	A	8 × $.49 = ■	I	3 × $.27 = ■
3 × $.92 = ■	L	9 × $2.09 = ■	B	6 × $4.25 = ■	J	9 × $1.41 = ■
9 × $.18 = ■	M	4 × $.59 = ■	C	5 × $.34 = ■	K	7 × $.80 = ■
5 × $1.39 = ■	N	2 × $3.16 = ■	D	3 × $3.08 = ■	L	8 × $4.05 = ■
4 × $2.20 = ■	O	7 × $.62 = ■	E	9 × $.63 = ■	M	2 × $.79 = ■
2 × $7.50 = ■	P	6 × $1.88 = ■	F	4 × $.77 = ■	N	6 × $.24 = ■
6 × $.76 = ■	Q	8 × $2.17 = ■	G	2 × $.85 = ■	O	5 × $2.25 = ■
8 × $.45 = ■	R	3 × $5.21 = ■	H	7 × $5.30 = ■	P	4 × $5.02 = ■

2

Now you should be able to multiply amounts of money by one-figure numbers.

Keeping skillful

3

28 + 47 + 39 = ■
709 + 805 = ■
253 + 458 + 170 = ■
541 + 633 + 225 = ■
87 + 92 + 60 = ■
913 + 784 + 54 = ■
500 + 392 + 176 = ■
48 + 107 + 75 = ■
26 + 19 + 34 = ■
208 + 516 = ■
836 + 241 = ■
769 + 500 + 350 = ■
426 + 52 + 89 = ■
948 + 202 + 590 = ■
577 + 688 = ■
84 + 173 + 97 = ■

4

A ■ + 249 = 600
B 73 + ■ = 141
C 687 − 215 = ■
D 803 − ■ = 116
E ■ − 58 = 207
F ■ + 1531 = 2703
G 8621 − 4935 = ■
H ■ − 327 = 452
I 700 − 168 = ■
J 165 + ■ = 309
K 624 − ■ = 96
L 4000 − 2554 = ■
M ■ + 582 = 609
N 926 − 438 = ■
O 8002 − 5671 = ■
P 748 + ■ = 1089

5

A 6 × 43 = ■
B 9 × 500 = ■
C 74 × 7 = ■
D 3 × 628 = ■
E 5 × 86 = ■
F 718 × 2 = ■
G 4 × 96 = ■
H 80 × 7 = ■
I 8 × 900 = ■
J 3 × 55 = ■
K 87 × 6 = ■
L 9 × 79 = ■
M 5 × 430 = ■
N 30 × 3 = ■
O 8 × 123 = ■
P 19 × 7 = ■

156

1. Assign Problems A and B and Exercises C to R as written work. Tell pupils to write the numbers in computational form and find the answers. Provide answers so that they may verify their work.
2. These exercises may be assigned as extra practice for those who need it.
3. Have pupils write these addition exercises in computational form and find the answers.
4. Tell pupils to write these exercises in computational form and compute. If pupils have difficulty with any of them, refer them to the original treatments in the book for restudy.
5. Have pupils write these multiplication exercises in computational form and find the answers.

157-158 Using arithmetic

panded Notes are not considered necessary for this lesson.

bjectives

he child solves a variety of problems, many of which equire multiplication of two-figure and three-figure umbers by one-figure numbers. In the "Keeping skillful" exercises he reviews the number system and multiplying two-figure and three-figure numbers by one-figure umbers.

ocabulary

ew words page 157 troop, meets*, dues; page 158 gar*

omments

his problem set gives children an opportunity to apply eir knowledge of multiplying two-figure and three-gure numbers by one-figure numbers. As always, a few oblem situations of different types are included.

Since problems in textbooks should simulate real life uations and since in real life situations problems do not always come singly, but in "chains" or sequences, authors of arithmetic texts must provide situations in which the work in one problem depends upon the data or work in preceding problems. Failure to make this provision would leave the child inadequately prepared for the more complex arithmetic situations of his everyday life. This set of problems takes the initial step toward this provision. For the first time children must make use of information obtained from a previous problem. Problem G introduces this kind of situation, with a paragraph entitled "Think" to help children decide what to do. The solution of Problem R depends upon the use of the solutions of the two previous problems. This problem also has a "Think" paragraph to guide children. Problems of this type have been included to give children experience in seeing the whole situation. Subsequent "Using Arithmetic" lessons will include problems which depend upon preceding problems for their solution.

Remind the children to make the equation first for each problem. Remind them, too, that in the case of

multiplication, regardless of the order of the numbers in the equation, they may multiply by the more convenient number in their computation.

The "Keeping skillful" exercises at the end of this problem set help to establish some of the recently learned concepts and skills.

Answers

Using arithmetic:

A $6 \times 4 = [24]$
B $8 \times \$1.80 = [\$14.40]$
C $54 \div [9] = 6$
D $7 \times 150 = [1050]$
E $9 \times 8 = [72]$
F $8 \times 13 = [104]$
G $104 - 72 = [32]$
H $63¢ \div [9¢] = 7$
I $5 \times \$1.29 = [\$6.45]$
J $7 \times 24 = [168]$
K $14 \times 3 = [42]$
L $9 \times \$1.12 = [\$10.08]$
M $4 \times \$1.75 = [\$7.00]$
N $5¢ + [10¢] = 15¢$
O $3 \times \$1.98 = [\$5.94]$
P $49 + 51 + 35 = [135]$
Q $25 \times 5 = [125]$
R $135 - 125 = [10]$
S $42 + [15] = 57$
T $57 \times 3 = [171]$
U $5 \times 36 = [180]$
V $64 \div [8] = 8$
W $5 \times 12 = [60]$
X $32 \div [8] = 4$
Y $4 \times \$1.75 = [\$7.00]$

Keeping skillful:

(block 1)	(block 2)	(block 3)
A 4300	A $7.60	A 2640
B 190	B $42.00	B 168
C 21000	C $3.10	C 728
D 57000	D $1.68	D 6461
E 1200	E $29.52	E 340
F 9800	F $43.89	F 2100
G 1150	G $3.44	G 1900
H 88000	H $10.71	H 1044

Using arithmetic 1

A Sue's Brownie troop meets 4 times a month. How many times does it meet in 6 months?

B Sue collects the dues each week from the girls in her troop. Each week she collects $1.80. How much does she collect in dues in 8 weeks?

C The Brownies made 54 toys to give away. They put the same number of toys into each of 6 boxes. How many toys did they put into each box?

D Some of the Brownies made bean bags. They made 7 bean bags in all. Ann said that there were about 150 beans in each bag. About how many beans were there in all 7 bags?

E Ann made 9 clown hats. She used 8 bells for each clown hat. How many bells did she use in all?

F Sue made 8 clown hats. She used 13 bells for each clown hat. How many bells did she use in all?

G How many more bells did Sue use for the 8 clown hats she made than Ann used for the 9 clown hats that she made?

THINK In Problem E you found out how many bells Ann used. What does Problem F tell you?

H Ellen's troop has a garden. They spent 63¢ for seeds. 7 girls shared the cost of the seeds equally. What was each girl's share of the cost?

I The girls also bought 5 rakes. Each rake cost $1.29. How much in all did the girls spend for the 5 rakes?

J Each of 7 girls set out 24 plants. How many plants in all did they set out?

K Each of 14 girls brought 3 books to a Brownie meeting. How many books did the 14 girls bring to the Brownie meeting?

L Mary collects the dues each week from the girls in her troop. Each week she collects $1.12. How much does she collect in dues in 9 weeks?

M Each of 4 Brownie troops gave $1.75 to the Red Cross. How much money in all did the 4 troops give?

N Mary has 5¢. She needs 15¢ to pay her troop dues. How much more money must she have before she can pay her troop dues?

O Carol's troop bought 3 books. Each book cost $1.98. How much altogether did the 3 books cost?

157

1 Assign these problems and those on the fo
lowing page as written work. You might ca
tion the children that for some of the proble
they will have to use information that th
found in solving a previous problem. Su
problems all are followed by paragrap
labeled "Think." Instruct the children to wri
the equation for each problem with the scre
in the proper place first, then to comput
find the answer, and, finally, rewrite the equ
tion with the answer in place of the scre

P The Brownies made 3 kinds of cookies at one of their meetings. They made 49 sugar cookies, 51 chocolate cookies, and 35 nut cookies. How many cookies did they make altogether?

Q Ann put 5 of these cookies into each of 25 small bags. How many cookies in all did she put into bags?

R How many cookies did Ann have left over?

THINK In Problem P you found out how many cookies the girls made. In Problem Q you found out how many cookies Ann put into bags.

S The Brownies had a picnic. When it began, 42 girls were there. More girls came to the picnic after it began. Then there were 57 girls at the picnic. How many of the girls came after the picnic began?

T Each of the 57 girls ate 3 cupcakes. How many cupcakes did the girls eat?

U Mary and Sue helped to put food on 5 tables. They put 36 sandwiches on each table. They put how many sandwiches in all on the 5 tables?

V Ann said, as she counted a pile of paper plates, "These 64 plates came out of 8 packages. I know that there was the same number of plates in each package. I wonder how many there were in each package." There were how many plates in each package?

W The girls put 12 of these plates on each of the 5 tables. How many of the 64 plates did they use?

X 32 girls separated into 4 teams for a race. There was the same number of girls on each team. There were how many girls on each team?

Y Each of 4 girls spent $1.75 for picnic food. How much did they spend in all for picnic food? 1

Keeping skillful

3

4

A	43 hundreds = 43~ 2	A $8 \times \$.95 =$ ■	A $330 \times 8 =$ ■
B	19 tens = ■	B $5 \times \$8.40 =$ ■	B $6 \times 28 =$ ■
C	21 thousands = ■	C $2 \times \$1.55 =$ ■	C $4 \times 182 =$ ■
D	57 thousands = ■	D $6 \times \$.28 =$ ■	D $7 \times 923 =$ ■
E	120 tens = ■	E $3 \times \$9.84 =$ ■	E $68 \times 5 =$ ■
F	98 hundreds = ■	F $7 \times \$6.27 =$ ■	F $3 \times 700 =$ ■
G	115 tens = ■	G $4 \times \$.86 =$ ■	G $2 \times 950 =$ ■
H	88 thousands = ■	H $9 \times \$1.19 =$ ■	H $116 \times 9 =$ ■

158

1 After these problems have been solved, provide answers so that the children may verify their own work. Then find out which problems caused the most difficulty and discuss them with the class.

2 Direct the children to write the answers opposite the identifying letters on their papers.

3 Caution the children to put points and dollar signs in their answers.

4 Tell the children to multiply by the easier number.

159-160 Moving forward

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to multiply two-figure and three-figure numbers by a two-figure number that ends in zero and by a three-figure number that ends in two zeros.

Vocabulary

There are no new words.

Comments

This lesson prepares the children to understand that, in an example like 26×34, when they multiply by the 2, they are really mutiplying by 2 tens or 20. The partial product of 2×34 is then 68 tens, or 680, not just 68. In this lesson emphasis is focused only on the number of zeros that results in the answer when numbers are multiplied by 10, 100, 20, 200, and so on. In the exercises to be worked, all except the final zero portion of each product is supplied. Only the necessary zeros must be annexed. In the examples provided in the book for developmental work, the annexed zeros are indicated in blue type.

This lesson is based on concepts that the children have already learned in studying the number system. Important here is the understanding of how the number symbols can be reinterpreted to correspond to a regrouping of objects. This idea, introduced in Book 3, is reviewed in this book on pages 11-15. Briefly, these pages showed that 10 ones can be thought of and written as 1 ten; that 10 tens can be thought of and written as 1 hundred; and that 10 hundreds can be thought of and written as 1 thousand. Thus, 14 tens can be thought of and written as 1 hundred 4 tens 0 ones, or 140.

The work on page 138 helped generalize the idea that quantities like 14 tens or 140 tens can be represented in number symbols by annexing one zero to the tens; thus 14 tens becomes 140, and 140 tens becomes 1400.

Pages 140 to 141 introduced the idea of multiplying numbers such as 10, 100, 20, or 200 by one-figure numbers and showed that when the order of the factors is

reversed, the product is the same. These ideas are extended here to include two-figure numbers and three-figure numbers and to show what happens when such numbers are multiplied by 10 and 100 or 20 and 200. The children should learn in this lesson that the number of annexed zeros at the right of the number in the answer is the same as the number of zeros at the right of the multiplier.

Answers

Page 159:

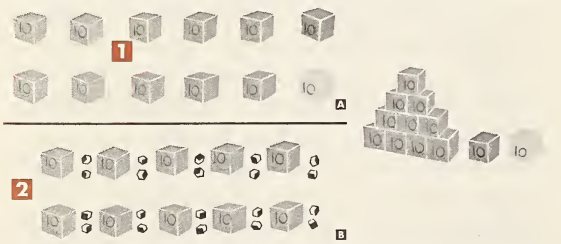
(block 1)		(block 2)		
E 650	I 3420	C 3000	G 41100	K 7800
F 360	J 1960	D 21200	H 59300	L 30100
G 1200	K 5040	E 8500	I 9900	
H 2400	L 7300	F 1900	J 64600	

Page 160:

(block 1)		(block 2)	
C 1260	F 1120	C 10800	F 15600
1680	G 2220	14400	G 13500
D 1200	H 2520	D 17400	H 19600
E 4600	I 2030	E 24000	I 9500

Moving forward

This lesson will show you how to multiply by a number like 10, 20, 100, or 200.



3 A 12 tens = 10 twelves
$12 \times 10 = 10 \times 12$ 120

B 14 tens = 10 fourteens
$14 \times 10 = 10 \times 14$ 140

4

5
C $10 \times 18 = 180$
D $10 \times 24 = 240$
E $10 \times 65 = 65$—
F $10 \times 36 = 36$—
G $10 \times 120 = 1200$
H $10 \times 240 = 240$—
I $10 \times 342 = 342$—
J $10 \times 196 = 196$—
K $10 \times 504 = 504$—
L $10 \times 730 = 730$—

A 6 hundreds = 100 sixes
$6 \times 100 = 100 \times 6$ **6** 600

B 15 hundreds = 100 fifteens
$15 \times 100 = 100 \times 15$ 1500 **6**

7
C $100 \times 30 = 30$—
D $100 \times 212 = 212$—
E $100 \times 85 = 85$—
F $100 \times 19 = 19$—
G $100 \times 411 = 411$—
H $100 \times 593 = 593$—
I $100 \times 99 = 99$—
J $100 \times 646 = 646$—
K $100 \times 78 = 78$—
L $100 \times 301 = 301$—

Now turn the page.

159

1 Get pupils to observe that the first scene of Movie A shows 12 tens. Let them discover that the scene at the right shows these blocks of tens rearranged so that there are 10 tens (or 100) in the pile, 2 tens, and no ones.

2 Let the children discover that there are 10 groups of 12 blocks and that these 10 groups can be rearranged to make the pile of 100 and 2 boxes of tens at the right. Help them decide that 12 tens and 10 twelves are equal.

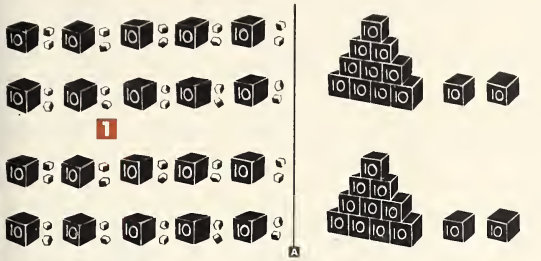
3 After pupils have read the top statement, help them to see that the statement below is another way of saying the same thing. The pupils should observe that the result of multiplying a number by 10 can be shown by putting a zero at the right of the number.

4 Have pupils discuss these statements.

5 Tell pupils to write these answers.

6 Bring out that annexing two zeros to the number has the effect of multiplying by 100.

7 Have pupils write these answers.



A 10 twelves = 10 × 12, or 120
20 twelves = 20 × 12, or 240
30 twelves = 30 × 12, or 360

B 10 eighteens = 10 × 18, or 180
20 eighteens = 20 × 18, or 360
30 eighteens = 30 × 18, or 540

C 20 × 42 = 840
30 × 42 = 126~
40 × 42 = 168~

D 20 × 60 = 120~
E 50 × 92 = 460~
F 80 × 14 = 112~
G 60 × 37 = 222~
H 40 × 63 = 252~
I 70 × 29 = 203~

A 100 fifteens = 100 × 15, or 1500
200 fifteens = 200 × 15, or 3000
300 fifteens = 300 × 15, or 4500

B 100 forties = 100 × 40, or 4000
200 forties = 200 × 40, or 8000
300 forties = 300 × 40, or 12000

C 200 × 36 = 7200
300 × 36 = 108~
400 × 36 = 144~

D 200 × 87 = 174~
E 600 × 40 = 240~
F 400 × 39 = 156~
G 300 × 45 = 135~
H 700 × 28 = 196~
I 500 × 19 = 95~

Now you should be able to multiply by numbers like 10, 20, 100, and 200.

50

160

1 Let pupils observe that there are 20 groups of 12 blocks in the first scene of Movie A. Then let them conclude, from the second scene, that 20 twelves, rearranged, make 2 hundreds and 4 tens.

2 Call on pupils to read these examples. Ask which statement Movie A illustrates. The children should be aware that when a number is multiplied by a number ending in one zero, one zero must be put at the right in the answer.

3 Have these examples read.

4 Let pupils write the complete product for each statement, C to I. Then have each answer read aloud.

5 Have these examples read aloud. Get children to observe that when they multiply by hundreds, the last two figures in their answers will be zeros.

6 Let pupils finish Exercises C to I, writing the complete answers to each. Have the pupils then read their answers aloud.

161-164 Learning how

Expanded Notes for this lesson are on pages 303-305.

Objectives

The child learns to multiply a two-figure number by any two-figure number.

Vocabulary

New words page 161 own*

Comments

In the preceding lesson children learned to multiply by numbers ending in zero. Now they learn to multiply by any two-figure number, and they learn the computational form used in such multiplication.

To understand this process, the children must use several of the ideas about the number system that they already know. The following three ideas are especially important here. First, two-figure numbers are composed of tens and ones. Second, multiplication may involve the kind of regrouping that is called "carrying." Third, when the tens' figure in the multiplier is used, the product will represent groups of tens; the product should be written with an annexed zero at the right and will be read as hundreds or thousands. In the multiplication 13×26, for example, children should think of the 1 in 13 as 1 ten so that the partial product is 1 ten×26, or 26 tens, or 260. In the multiplication 46×78, they should think of the 4 in 46 as 4 tens, and of the partial product not as 4×78, or 312, but as 4 tens×78, which is 312 tens, or 3120.

The four-step teaching method is used again in this lesson. As usual, the part of a picture not under discussion is dimmed; the numerals under discussion in the computation are in black type. In the SEE step, the process has been broken down to show the multiplication involved for each figure in the multiplier, as first by 3 ones and then by 1 ten. Afterwards, the two products are combined. Be sure that as the children study this work, they understand what each partial product in the computation stands for, as described opposite Picture E, page 162. In the THINK step on page 163, the work is

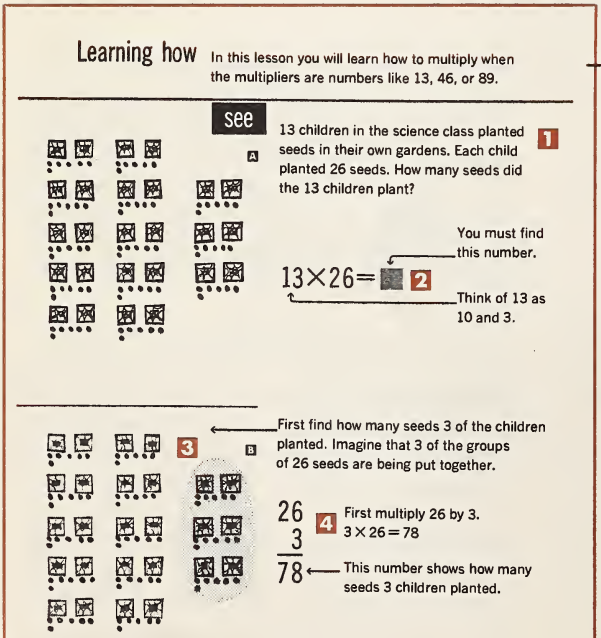
put together as the multiplying is done, in the usual arrangement.

As with previous work involving multiplication with carrying, watch to see that children do not add in the carried numbers first (as in addition) but after the multiplying. However, do not warn the class about this. Most of the children will not make this mistake.

Answers

Page 164:

(block 1)				(block 2)			
A	392	K	3120	A	5700	K	1710
B	650	L	4608	B	4000	L	2774
C	1180	M	874	C	539	M	1334
D	4048	N	3080	D	5642	N	923
E	1566	O	1080	E	918	O	770
F	3150	P	1856	F	3216	P	3652
G	3080	Q	2430	G	1102	Q	2590
H	1350	R	2914	H	900	R	4761
I	3588	S	9025	I	1566		
J	1425	T	4745	J	990		


Learning how
In this lesson you will learn how to multiply when the multipliers are numbers like 13, 46, or 89.
see
A
13 children in the science class planted seeds in their own gardens. Each child planted 26 seeds. How many seeds did the 13 children plant?
1
You must find this number.
13×26=■ 2
Think of 13 as 10 and 3.
3
B
First find how many seeds 3 of the children planted. Imagine that 3 of the groups of 26 seeds are being put together.
26
3
78
4
First multiply 26 by 3.
3×26=78
This number shows how many seeds 3 children planted.
Now turn the page.
Multiplication by a 2-figure multiplier 161

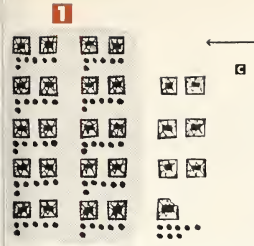
161

1 Have this problem read. Then get the children to see that the picture represents 13 groups of 26 seeds.

2 Ask a pupil to explain this equation in terms of the problem and the picture. Be sure pupils understand that they are to think of 13 as 1 ten and 3 ones.

3 Explain that first they will find how many seeds 3 of the children planted and that to do this, the seeds they planted will be put together. Call on a pupil to tell how the picture shows this.

4 Have pupils look at this computation. Help them see that the 26 shows the size of each group and that the 3 is the number that tells the number of groups being put together first. Ask them to multiply, to make sure that the figures in the book are right. Make certain that they realize the answer so far shows only how many seeds 3 children planted.



Now find how many seeds 10 children planted. Imagine that the 10 groups of 26 seeds are put together.

```
 26
 10
260
```

Multiply the 26 by 10.

10 × 26 = 260. This number shows how many seeds 10 children planted.

To find out how many seeds all 13 children planted, imagine that the seeds planted by 3 children and by 10 children are put together.

```
 78
260
338
```

Add 78 and 260.

The sum of 78 and 260 is 338.

There are 338 seeds in all.

You should write all of the work in one place, like this.

```
 26
 13
 78
260
338
```

Seeds 3 children planted

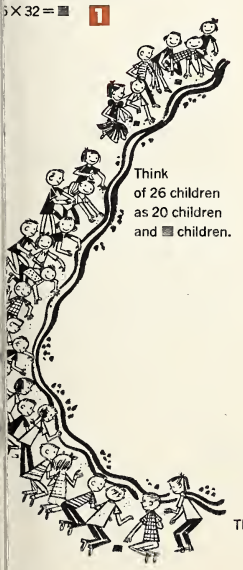
Seeds 10 children planted

Seeds all 13 children planted

The children planted 338 seeds.
13 × 26 = 338

think Another day 26 children wanted 32 seeds apiece. How many seeds did the children plant this time?

5 × 32 = ■



Think of 26 children as 20 children and ■ children.

```
 32
 26
192
```

First find how many seeds ■ children planted.

First multiply 32 by ■.

6 × 32 = ■. This shows how many seeds ■ children planted.

Now find how many seeds ■ children planted.

Now multiply ■ by 20.

20 × 32 = ■. Write ■ under 192 so that you can add. This number shows how many seeds ■ children planted.

```
 32
 26
192
640
```

Now find how many seeds all 26 children planted. How do you do this?

192 + 640 = ■

The children planted ■ seeds this time.

Now turn the page.

162

1 Help the children decide that next they are to find how many seeds 10 children planted. Call on someone to explain how the picture shows this. Point out that the dimmed seeds are the 3 groups of seeds discussed before, now rearranged to show the total of 78 seeds.

2 Help pupils see that the 26 stands for the number of seeds in a group and that the 10 is the number of groups being put together now. Pupils should know immediately that 10×26 equals 260.

3 Help children see why the seeds planted by 3 children are put with those planted by 10 children. Then have the children relate the 78 and the 260 in the computation to the picture.

4 Have a pupil explain how the picture shows 338 seeds in all. Make sure pupils understand what each of the numbers in the computation stands for. Explain that this is the arrangement usually used.

163

1 Have the children read this problem and discuss the equation. Let them use the illustration to help them think of 26 children as 2 tens (or 20) and 6 ones.

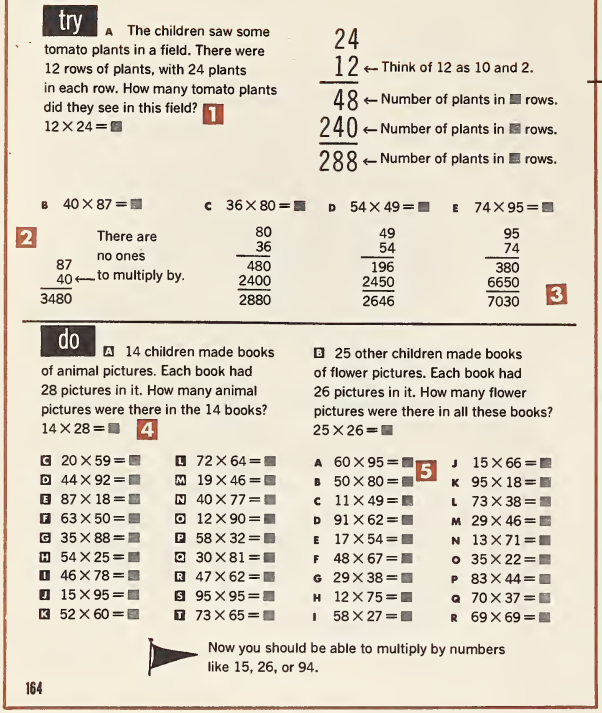
2 Make sure the children understand that first they find out how many seeds 6 of the children planted. Have them note that, although they are multiplying only by the ones (6), the complete number (26) is written because they will use the 2 (or 20) later.

3 Have the children multiply 32 by 6 to check the work in the book. Call on a pupil to read the statements, completing them.

4 Make sure the children realize that now they are going to multiply by the 2 tens (20).

5 Have them multiply 32 by the 2 tens and note where the result is written. They should understand that now they add the seeds 6 children planted to those 20 children planted.

6 Call on children to explain each number in this computation.



try

A The children saw some tomato plants in a field. There were 12 rows of plants, with 24 plants in each row. How many tomato plants did they see in this field? 1
12 × 24 = ■

24
12 ← Think of 12 as 10 and 2.
48 ← Number of plants in ■ rows.
240 ← Number of plants in ■ rows.
288 ← Number of plants in ■ rows.

B 40 × 87 = ■

2
There are no ones
87
40 ← to multiply by.
3480

C 36 × 80 = ■

80
36
480
2400
2880

D 54 × 49 = ■

49
54
196
2450
2646

E 74 × 95 = ■

95
74
380
6650
7030
3

do

A 14 children made books of animal pictures. Each book had 28 pictures in it. How many animal pictures were there in the 14 books?
14 × 28 = ■ 4

B 25 other children made books of flower pictures. Each book had 26 pictures in it. How many flower pictures were there in all these books?
25 × 26 = ■

C 20 × 59 = ■
D 44 × 92 = ■
E 87 × 18 = ■
F 63 × 50 = ■
G 35 × 88 = ■
H 54 × 25 = ■
I 46 × 78 = ■
J 15 × 95 = ■
K 52 × 60 = ■

L 72 × 64 = ■
M 19 × 46 = ■
N 40 × 77 = ■
O 12 × 90 = ■
P 58 × 32 = ■
Q 30 × 81 = ■
R 47 × 62 = ■
S 95 × 95 = ■
T 73 × 65 = ■

A 60 × 95 = ■
B 50 × 80 = ■
C 11 × 49 = ■
D 91 × 62 = ■
E 17 × 54 = ■
F 48 × 67 = ■
G 29 × 38 = ■
H 12 × 75 = ■
I 58 × 27 = ■
5

J 15 × 66 = ■
K 95 × 18 = ■
L 73 × 38 = ■
M 29 × 46 = ■
N 13 × 71 = ■
O 35 × 22 = ■
P 83 × 44 = ■
Q 70 × 37 = ■
R 69 × 69 = ■

Now you should be able to multiply by numbers like 15, 26, or 94.

164

164

1 Discuss this problem and its solution orally.
2 Assign these examples as written work. Tell pupils to write the necessary computation, find the answers, and then compare their work with the computation shown in the book. Make sure, in discussing the work for Example B, that children understand that no multiplying was done with ones, since there were no ones. The zero in the answer shows the written form of 348 tens.
3 Direct the children to proceed to the work marked DO just as soon as they are sure they know how to multiply.
4 Have Problems and Exercises A to T done as written work. Supply answers and have the children verify their work.
5 Assign these exercises as written work for those who need extra practice.

165-166 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child makes equations for problems and selects the correct process to use in finding the answers. He practices multiplication in the "Keeping skillful" exercises.

Vocabulary

New words page 165 asked*, napkins, vanilla, lemonade, fill*

Comments

The problems in this set will increase the children's ability to set up equations that correctly describe the action expressed in the problems. Some of the problems will give the pupils practice in multiplication with a two-figure multiplier to which they were introduced in the preceding lesson.

In the problems solved by multiplication, the pupils should, of course, be permitted to use the smaller number as the multiplier to simplify the computation. But it should be pointed out to the children that sometimes, in Problems G and J for example, the larger number is the number of equal groups.

Answers

Using arithmetic:

A 42+39=[81] or 39+42=[81]
B 81÷[9]=9
C 35+[36]=71
D 9×12=[108]; yes
E 14×12=[168]
F More; 168−108=[60]
G 14×2=[28]
H 14−7=[7]
I 96−[81]=15
J 27×3=[81]; yes
K 40×2=[80]; no
There were 81 children.
L [4]+9=13
M 13×2=[26]
N 24×12=[288]
O $9.50+$7.25=[$16.75] or $7.25+$9.50=[$16.75]
P $16.75+[$2.70]=$19.45
Q 27÷3=[9]

Keeping skillful:

(block 1)

A 3792	D 2482	G 2970	J 3276	M 3612
B 1360	E 1455	H 925	K 6789	N 513
C 1298	F 2976	I 990	L 2958	O 3420

(block 2)

A 1800	D 2880	G 8448	J 1972	M 6208
B 1012	E 2552	H 1444	K 4140	N 2668
C 1645	F 1755	I 2052	L 368	O 1472

(block 3)

A 4840	C 12480	F 5700	I 9860	L 10600
7260	D 6600	G 4200	J 2050	M 10120
B 2200	E 8430	H 18720	K 15960	

Using arithmetic 1

A The fourth-grade children asked the third-grade children to a party. 42 children came from the fourth grade, and 39 children came from the third grade. How many children came to the party?

B 9 of the girls said they would make enough napkins so that each child could have one. Each girl was to make the same number of napkins. How many napkins was each girl to make?

THINK The answer for Problem A tells you how many napkins the girls said they would make altogether.

C One day the children made 35 hats for the party. The next day they made some more. Then John counted the hats and said, "We have made 71 hats." How many hats did they make the second day?

D Ann's mother made 9 dozen sugar cookies for the party. How many cookies did she make altogether? Did she make enough so that each child could have 1 cooky?

THINK How do you know how many children came to the party?

E May's mother made 14 dozen cookies for the party. How many cookies did she make altogether?

F Did May's mother make more or fewer cookies than Ann's mother? How many more or fewer did she make?

THINK Which problem tells you how many cookies Ann's mother made? 2

G The children needed 14 quarts of ice cream. This amount of ice cream was equal to how many pints?

H 7 quarts of the ice cream they bought were chocolate, and the rest were vanilla. How many quarts of vanilla ice cream did they buy?

THINK From which problem do you get the other number that you need? 2

I The children bought 96 paper plates. After they had set the tables, they still had 15 paper plates left. How many paper plates had they used to set the tables?

J 27 of the girls made place cards for the party. Each girl made 3 place cards. Did the girls make enough place cards so that each child could have one?

K The children made 40 pints of lemonade. Each pint would fill 2 paper cups. Did they make enough lemonade for each child to have 1 cup? How do you know?

165

1 Have the children work independently on Problems A to Q (L to Q are on page 166). They should write the equation, do the computation, and rewrite the equation with their answer inserted in place of the screen.

2 The "Think" step in some of these problems is given to point out to the pupils that information from previous problems is needed in solving them. Warn the children that sometimes the answer for a problem is used in finding the answers to other problems.

L They also made some games to play at the party. On Monday they made some, and on Tuesday they made 9 more. Bill counted the games and said, "We have made 13 games for our party." How many games had they made on Monday?

M There were 2 prizes for each game. How many prizes were there for all of the games?

THINK How many games did they make?

N Twenty-four mothers made some sandwiches for the party. Each mother made 12 sandwiches. How many sandwiches did they make altogether?

O Some of the fourth-grade children earned $9.50 to help pay for the party. Other fourth-grade children earned $7.25. How much money did these two groups of children earn altogether?

P The total cost of the party was $19.45. How much more money did they still need to pay for the party?

THINK Problem O tells you how much money the fourth graders earned.

Q Some of the children at the party had a race. They had to run 27 feet in the race. How many yards did they have to run?

1

Keeping skillful

2

A 48 × 79 = ■
B 16 × 85 = ■
C 22 × 59 = ■
D 73 × 34 = ■
E 15 × 97 = ■
F 62 × 48 = ■
G 45 × 66 = ■
H 37 × 25 = ■
I 55 × 18 = ■
J 84 × 39 = ■
K 73 × 93 = ■
L 51 × 58 = ■
M 43 × 84 = ■
N 19 × 27 = ■
O 95 × 36 = ■

2

A 24 × 75 = ■
B 11 × 92 = ■
C 47 × 35 = ■
D 32 × 90 = ■
E 58 × 44 = ■
F 65 × 27 = ■
G 88 × 96 = ■
H 76 × 19 = ■
I 38 × 54 = ■
J 29 × 68 = ■
K 92 × 45 = ■
L 16 × 23 = ■
M 64 × 97 = ■
N 58 × 46 = ■
O 23 × 64 = ■

3

A 10 × 242 = 2420
20 × 242 = 484~
30 × 242 = 726~
B 20 × 110 = 220~
C 40 × 312 = 1248~
D 10 × 660 = 660~
E 30 × 281 = 843~
F 50 × 114 = 570~
G 40 × 105 = 420~
H 60 × 312 = 1872~
I 20 × 493 = 986~
J 10 × 205 = 205~
K 30 × 532 = 1596~
L 50 × 212 = 1060~
M 20 × 506 = 1012~

166

166

1 Discuss any of the problems that caused difficulty.

2 Have the children find answers to these exercises.

3 These exercises can be used for oral practice. The children should be able to respond without hesitation. If there seems to be difficulty with these exercises, the lesson on pages 159 to 160 should be reviewed. The children may also be required to write the numbers.

167 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child extends his knowledge of multiplication to include multiplication of three-figure numbers by two-figure numbers and applies this knowledge to multiplication of money. He also learns a new way to read numbers of four figures.

Vocabulary

There are no new words.

Comments

This lesson extends multiplication involving a two-figure multiplier to include a three-figure multiplicand. Multiplication of money is also included in this lesson. The fact that multiplication of money involves exactly the same procedures as the multiplication of numbers representing other things should be pointed out.

The "Side trip" on this page gives the children an exercise in reading numbers of four figures both in the way in which they were originally taught to read them and in a way in which they may often hear them.

Answers

(block 1)

C 16,284	F 37,882	I 35,475	L 21,470
D 34,151	G 16,920	J 7630	
E 30,600	H 22,100	K 24,998	

(block 2)

C $52.90	F $137.40	I $90.44	L $28.08
D $7.20	G $321.36	J $9.46	
E $20.50	H $354.05	K $168.20	

Keeping skillful

A $36 \times 597 =$ ■

1
597 — First multiply by ■.
36 ← Then multiply by 30.

3582 — How do you get this number?
17910 ← this number?
21492 ← How do you get this number?

B $50 \times 305 =$ ■

2
305 — What do you multiply by here?
50 ←
15250

A $82 \times \$1.57 =$ ■

4
$1.57
82
3.14 ← Some people do not put a point in these numbers.
125.60 ←
$128.74 ← Always put a point and a dollar sign in the answer.

B $70 \times \$.18 =$ ■

5
$.18
70
$12.60

6

C $23 \times 708 =$ ■
D $37 \times 923 =$ ■
E $50 \times 612 =$ ■
F $94 \times 403 =$ ■
G $18 \times 940 =$ ■
H $85 \times 260 =$ ■
I $43 \times 825 =$ ■
J $70 \times 109 =$ ■
K $58 \times 431 =$ ■
L $95 \times 226 =$ ■
M $97 \times \$3.65 =$ ■
N $76 \times \$1.19 =$ ■
O $43 \times \$.22 =$ ■
P $29 \times \$5.80 =$ ■
Q $36 \times \$.78 =$ ■
C $46 \times \$1.15 =$ ■
D $16 \times \$.45 =$ ■
E $82 \times \$.25 =$ ■
F $60 \times \$2.29 =$ ■
G $78 \times \$4.12 =$ ■

Side trip

A 3400
three thousand four hundred
thirty-four hundred

B 7615
seven thousand six hundred fifteen
seventy-six hundred fifteen

7

Read in two ways.

A	2812	F	4258	K	7072
B	5786	G	6700	L	2965
C	3819	H	9001	M	1070
D	1468	I	8375	N	5900
E	7500	J	4000	O	8111

167

167

1 Discuss this example with the children, and have them answer the questions that relate to the example.

2 Be sure the children understand how the multiplication in this example differs from that in the one above.

3 Have the pupils write these exercises in computational form and compute.

4 Discuss this example with the children and point out that the procedure for computing does not differ from that at the left. Explain why the points in the $3.14 [2×$1.57] and $125.60 [80×$1.57] are correct and also helpful in arriving at the correct answer.

5 Have the pupils work this example and compare their answers with the answer in the book.

6 Have the children compute to find the answers to these exercises. Have them check their work, especially the position of the points.

7 Use this as an oral exercise.

168-169 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child solves problems of various types.

Vocabulary

New words **page 168** hits*, pennants, distance*, inning*; **page 169** seats*, sitting*, around*

Comments

The emphasis in this set of problems is on multiplication involving larger numbers. It is important, as was pointed out in the preceding "Using arithmetic" lesson, that the children be aware which figure represents the number of equal groups and which represents the size of the equal groups, even though the computation may be simplified by reversing the numbers. For example, in Problem E it is obviously easier to multiply 26 by 20, but the pupils should know that 26 is the number of equal groups, and 20 is the size of the equal groups, because it will take 20 pennies to buy each hamburger.

The children should be permitted to work independently on these problems before any discussion of them is carried on. This not only will make the work more challenging for the children, but also will provide a basis for a discussion of the problems.

Answers

A $12 \times 35¢ = [\$4.20]$
B $6 \times \$2.75 = [\$16.50]$
C $7 \times 15¢ = [\$1.05]$
D $13 - 8 = [5]$
E $26 \times 20¢ = [\$5.20]$
F $8 \times 65¢ = [\$5.20]$
G $65¢ - 35¢ = [30¢]$
H $128 \times 3 = [384]$
I $25 - 12 = [13]$
J $12 - 9 = [3]$
K $\$5.00 - \$1.20 = [\$3.80]$
L $85¢ + \$1.95 = [\$2.80]$ or $\$1.95 + 85¢ = [\$2.80]$
M $[\$3.00] - \$1.29 = \$1.71$
N $2 \times 13 = [26]$
O $38¢ + [47¢] = 85¢$
P $6 \times \$.25 = [\$1.50]$
Q $23 \times 15 = [345]$
R $4 \times 90 = [360]$
S $2 \times 60 = [120]$
T $4 \times 18 = [72]$
U $3 \times 18 = [54]$
V $72 + 54 = [126]$ or $54 + 72 = [126]$
W More; $72 - 54 = [18]$

Using arithmetic 1

A One Saturday afternoon Jim's father took 12 boys to a baseball game. The tickets for the boys cost 35¢ apiece. How much did Jim's father pay for all of the boys' tickets?

B Six of the boys earned money for the baseball game by helping their fathers in the garden. Each boy earned $2.75 in this way. How much did all of these boys earn?

C At the baseball game, 7 of the boys bought boxes of popcorn. The popcorn cost 15¢ a box. How much in all did the popcorn cost?

D In the baseball game, the first team made 13 hits, and the second team made only 8 hits. How many fewer hits did the second team make than the first team?

E Jim's father bought 26 hamburgers during the baseball game. Each one cost 20¢. How much did he pay for all the hamburgers?

F 8 of the boys bought large pennants that cost 65¢ apiece. How much did all of these large pennants cost?

G Small pennants cost 35¢ apiece. A small pennant cost how much less than a large pennant? 2

H Jim's father said that the distance from home plate to the fence was 128 yards. How many feet was this?

I The first inning of the game lasted 25 minutes. The second inning lasted only 12 minutes. How many fewer minutes did the second inning last than the first inning?

J Jim's father bought ice-cream cones for the 12 boys. 9 of the boys wanted chocolate cones, and the others wanted vanilla cones. How many of the boys wanted vanilla cones?

K The ice-cream cones cost $1.20 in all. Jim's father gave the man $5. How much money should the man have given him in change?

L David bought a baseball cap for 85¢. He also bought a baseball bat for $1.95. How much did he pay for these two things?

M Bill had some money to spend at the game. He paid $1.29 for a new baseball. Then he had $1.71 left. How much money did he have to start with?

N In the baseball game each team used 13 players. How many players did the two teams use?

168

O The baseball cap that Jim wanted to buy cost 85¢, but he had only 38¢ left. His father gave him the rest of the money for the cap. How much money did his father give him?

P Each of six boys bought a bag of peanuts. Each bag cost $.25. How much did all of the bags cost?

Q There were 23 rows of seats where the boys were sitting. Each row had 15 seats. How many seats were there in these rows?

R The distance from one base to the next base was 90 feet. What was the total distance around all 4 bases?

S The baseball game lasted for two hours. How many minutes was this?

T Jack counted the lights on 4 poles at the ball field. There were 18 lights on each pole. How many lights in all did Jack count?

U Bob counted the lights on the other 3 poles at the ball field. There were also 18 lights on each pole that he counted. How many lights in all did Bob count?

V There were how many lights in all at the ball field? 1

THINK The answers for Problems T and U tell you how many lights Jack and Bob counted.

W Did Jack count more or fewer lights than Bob? How many more or fewer lights did he count? 2

Checking up

Test 1	Test 2	Test 3	Test 4
A 8 × 248 = ■	A 47 × 65 = ■	A 76 × 402 = ■	A 5 × $.19 = ■
B 3 × 957 = ■	B 59 × 84 = ■	B 29 × 113 = ■	B 38 × $6.24 = ■
C 5 × 700 = ■	C 91 × 78 = ■	C 58 × 765 = ■	C 72 × $1.06 = ■
D 7 × 88 = ■	D 14 × 29 = ■	D 19 × 284 = ■	D 40 × $.25 = ■
E 4 × 674 = ■	E 36 × 20 = ■	E 67 × 590 = ■	E 69 × $5.13 = ■
F 2 × 950 = ■	F 60 × 58 = ■	F 41 × 326 = ■	F 24 × $.86 = ■
G 6 × 807 = ■	G 24 × 95 = ■	G 90 × 605 = ■	G 87 × $4.60 = ■
H 9 × 564 = ■	H 72 × 18 = ■	H 32 × 948 = ■	H 10 × $.50 = ■
I 8 × 39 = ■	I 83 × 36 = ■	I 84 × 851 = ■	I 9 × $9.18 = ■
J 4 × 775 = ■	J 50 × 44 = ■	J 68 × 797 = ■	J 15 × $.75 = ■
K 5 × 90 = ■	K 38 × 64 = ■	K 47 × 130 = ■	K 58 × $2.20 = ■
L 8 × 113 = ■	L 49 × 80 = ■	L 12 × 977 = ■	L 7 × $5.35 = ■

End-of-block tests on multiplication 169

156

168

1 Let the children work independently on Prob lems A to W. Have them write the equatio with the screen, do the computation, and the rewrite the equation with the computed answe in place of the screen.

2 Note that to find the answer to this problem information from Problem F is required. Here the children are expected to know this withou the aid of a "Think" step.

169

1 In this problem, a suggestion is given in th paragraph titled "Think," since the answer from the two preceding problems are require

2 Discuss any problems on pages 168 and 16 that seemed to cause general difficulty.

169 Checking up

Exponded Notes are not considered necessory for this lesson.

Objectives

The pupil tests his skill in the multiplication of larger numbers by both one-figure and two-figure multipliers. He also tests his skill in multiplication of money by one-figure and two-figure multipliers.

Vocabulary

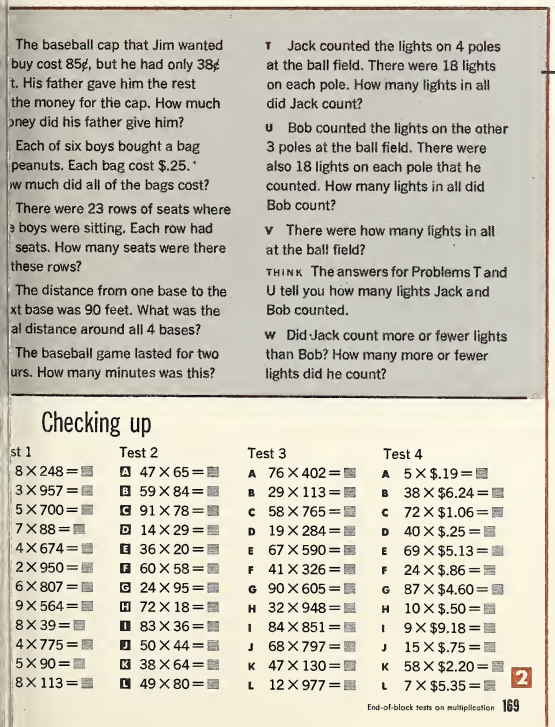
There are no new words.

Comments

The four tests in this lesson can be used as a means of determining the children's mastery of multiplication involving larger numbers. Test 4 also provides a checkup on their ability to multiply with numbers that represent dollars and cents. Any weaknesses revealed indicate that a review of the lessons on pages 142 to 146, 147 to 153, 154 to 156, 161 to 164, and 167 is necessary. The pupils should use the point and dollar sign in writing the numbers for computation and in their answers in Test 4.

Answers

Test 1		Test 2	
A 1984	G 4842	A 3055	G 2280
B 2871	H 5076	B 4956	H 1296
C 3500	I 312	C 7098	I 2988
D 616	J 3100	D 406	J 2200
E 2696	K 450	E 720	K 2432
F 1900	L 904	F 3480	L 3920
Test 3		**Test 4**	
A 30,552	G 54,450	A $.95	G $400.20
B 3277	H 30,336	B $237.12	H $5.00
C 44,370	I 71,484	C $76.32	I $82.62
D 5396	J 54,196	D $10.00	J $11.25
E 39,530	K 6110	E $353.97	K $127.60
F 13,366	L 11,724	F $20.64	L $37.45



The baseball cap that Jim wanted buy cost 85¢, but he had only 38¢ t. His father gave him the rest the money for the cap. How much oney did his father give him?

Each of six boys bought a bag peanuts. Each bag cost $.25. w much did all of the bags cost?

There were 23 rows of seats where boys were sitting. Each row had seats. How many seats were there these rows?

The distance from one base to the xt base was 90 feet. What was the al distance around all 4 bases?

The baseball game lasted for two urs. How many minutes was this?

T Jack counted the lights on 4 poles at the ball field. There were 18 lights on each pole. How many lights in all did Jack count?

U Bob counted the lights on the other 3 poles at the ball field. There were also 18 lights on each pole that he counted. How many lights in all did Bob count?

V There were how many lights in all at the ball field?

THINK The answers for Problems T and U tell you how many lights Jack and Bob counted.

W Did Jack count more or fewer lights than Bob? How many more or fewer lights did he count?

Checking up

st 1	Test 2	Test 3	Test 4
8×248=	A 47×65=	A 76×402=	A 5×$.19=
3×957=	B 59×84=	B 29×113=	B 38×$6.24=
5×700=	C 91×78=	C 58×765=	C 72×$1.06=
7×88=	D 14×29=	D 19×284=	D 40×$.25=
4×674=	E 36×20=	E 67×590=	E 69×$5.13=
2×950=	F 60×58=	F 41×326=	F 24×$.86=
6×807=	G 24×95=	G 90×605=	G 87×$4.60=
9×564=	H 72×18=	H 32×948=	H 10×$.50=
8×39=	I 83×36=	I 84×851=	I 9×$9.18=
4×775=	J 50×44=	J 68×797=	J 15×$.75=
5×90=	K 38×64=	K 47×130=	K 58×$2.20=
8×113=	L 49×80=	L 12×977=	L 7×$5.35=

2

End-of-block tests on multiplication 169

169

1 Test 1 is a test on multiplying with one-figure multipliers. Test 2 is a test on multiplying two-figure numbers by two-figure numbers. Test 3 is a test on multiplying three-figure numbers by two-figure numbers. Test 4 is a test on multiplication of numbers representing amounts of money. The pupils should work independently on these exercises. They should copy the exercises in computational form and compute. In test 4, be sure they use the dollar sign and point.

2 Provide answers so that the children can mark their work as correct or incorrect. Individual difficulties can be gone over separately at another time. Any reteaching needed by the whole class should be done at this time.

170-173 Exploring problems

Exponded Notes for this lesson are on poges 306-307.

Objectives

The child learns to solve problems in which he must compare a larger group with a smaller group by division.

Vocabulary

New words page 170 Mr.*; page 171 tadpoles; page 172 strawberries*; page 173 younger*

Comments

The child should be helped to understand that in comparing quantities he is dealing with two separate groups and that the objects in these groups do not have to be of the same kind. No action occurs in comparison situations; the groups are really static. The smaller group should be used for "measuring" the larger group. This is done by setting up in the larger group as many groups equal in size to the smaller group as possible.

For example, in this lesson the child compares a group of 18 pigs with a group of 6 lambs to find out how many times as many pigs there are as lambs. He does this by finding into how many groups of 6 pigs [because there are 6 lambs] the pigs can be divided. The group of 6 lambs in this problem serves as a measuring group. It is particularly important for the child to understand that in the equation $18 \div 6 = \square$ (used to solve this problem) the 6 stands for a group of pigs which is equal in size to the group of lambs. Note that in Picture B, on page 170, the lambs are dimmed off to show that once a corresponding group of pigs has been established, the lambs are no longer needed.

The division of the pigs into equal groups of 6 is shown by drawing rings around the groups. This enables the child to see that, once the size of the group has been established, the problem is of a type with which he is already familiar—finding how many equal groups there are. If any of the children have trouble understanding this kind of comparison problem, give them a group of objects to represent the pigs and a group of a different kind of objects to represent the lambs and let them establish a group of pigs equal in size to the group of lambs by one-to-one correspondence. Then have them divide the objects that represent pigs into equal groups of that size, and find how many such groups there are.

Answers

Exploring problems:

A	$24 \div 3 = [8]$	H	$63 - 45 = [18]$
B	$54 \div 9 = [6]$	I	$10 \div 5 = [2]$
C	$6 \div 2 = [3]$	J	$18 \div 9 = [2]$
D	$9 \div 3 = [3]$	K	$18 - 9 = [9]$
E	$64 \div 8 = [8]$	L	$20 \div 5 = [4]$
F	$8 - 4 = [4]$	M	$20 - 5 = [15]$
G	$63 \div 9 = [7]$	N	$4 \times 20 = [80]$

Keeping skillful:

(block 2)

A	360	G	882
B	92	H	2848
C	595	I	1484
D	627	J	9576
E	3336	K	35,358
F	3180	L	18,172

(block 3)

A	178	G	130
B	502	H	590
C	442	I	176
D	12,654	J	216
E	993	K	746
F	3825	L	303

see

Mr. White told David he had 18 baby pigs and 6 lambs. Mr. White had how many times as many pigs as lambs? 1

18 ← Number of pigs Mr. White had

Think of the 18 pigs as divided into groups of 6. Each group of 6 will be equal to the group of lambs.

$18 \div 6$ ← Divide by 6 because you think of the pigs in groups of 6.

2

Find how many groups of 6 pigs there are in 18 pigs. The number of groups of 6 tells how many times as many pigs as lambs there were.

$18 \div 6 = \square$ ← Number of groups of 6. It tells you how many times as many pigs as lambs there were.

You must find this number.

3

Comparing a larger group with a smaller group by division

compute

Divide the pigs into groups of 6.

$6\overline{)18}$ ← 3 ← 18 is 3 times as large as 6. 2

Mr. White had 3 times as many baby pigs as lambs.

1

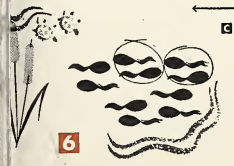
see

In a pond on Mr. White's farm, David caught 2 turtles and 10 tadpoles. He caught how many times as many tadpoles as turtles? 3

10 ← What does this number stand for?

Think of the ~~ as divided into groups. Each group will be equal to the group of ~~. Think of the tadpoles in groups of ■. 4

$10 \div 2$ ← Why do you divide by 2? 5



Find how many times you can make a group of ■ tadpoles.

$10 \div 2 = \square$ ← What will this number tell you?

6

Now turn the page.

170

1 Relate the problem to Picture A. Draw attention to the large numeral 18, which stands for the number of pigs.

2 Show pupils that a group of pigs equal to the number of lambs has been established, and a ring has been drawn around them. The 6 in the equation stands for a group of pigs equal to the group of 6 lambs. They are to find how many groups of 6 there are in the group of 18 pigs. The lambs are no longer needed.

3 In this picture the pigs are being divided into groups of 6. Discuss the equation. The number that is to be found will tell how many groups of 6 there are in 18. The screen in the equation represents this number. When the pupils know how many groups of 6 there are in 18, they also know how many times as many pigs there are as lambs.

171

1 Get the children to observe that the pigs have all been divided into groups of 6 and that there are 3 groups. Point out that this shows that the problem is solved by division.

2 Draw attention to the completed computation and relate it to Picture D.

3 Ask the children to read the problem and find in the picture the things mentioned in it. Be sure they know what the large numeral 10 stands for.

4 Have pupils use the picture to help them complete the statements in the text. They should see that the tadpoles are going to be put in groups of 2 because there are 2 turtles.

5 Direct attention to the equation and have pupils explain what the numbers in it mean.

6 Show the children that if rings were drawn around each group of 2 tadpoles, they could count the groups and find the number that goes where the screen is in the text. Another way is to divide 10 by 2, as shown in the equation.

compute

D

1 Divide the tadpoles into groups of ■

■ 10 is ■ times 2.

$2\overline{)10}$

David caught ■ times as many tadpoles as turtles.

A David counted 3 black baby chicks and 24 yellow baby chicks. He counted how many times as many yellow chicks as black ones?

2

Number of yellow chicks.
Number of yellow chicks equal to black chicks.
Number of groups of 3 yellow chicks.

$24 \div 3 = \square$

You must find this number.

Divide 24 by 3.
David counted ■ times as many yellow chicks as black ones.

B Mrs. White said that she had 9 ducks and 54 chickens. How many times as many chickens as ducks did she have?

3 $54 \div 9 = \square$

C David and Mrs. White used 6 pails of chicken feed and 2 pails of corn for the chickens and ducks. How many times as much chicken feed as corn did they use?

4 $6 \sim\sim 2 = \square$

D David helped Mr. White plant 3 rows of carrots and 9 rows of tomato plants. They planted how many times as many rows of tomatoes as carrots?

$9 \sim\sim 3 = \square$

E Mr. White said that he had 64 apple trees and 8 peach trees. He had how many times as many apple trees as peach trees?

5

F Mrs. White gave David's mother 4 jars of strawberries and 8 jars of tomatoes. Mrs. White gave her how many more jars of tomatoes than of strawberries?

G Mrs. White said that last year she canned 63 quarts of tomatoes and 9 quarts of tomato juice. She canned how many times as many quarts of tomatoes as tomato juice?

H Mrs. White also canned 45 quarts of peaches. How many fewer quarts of peaches than of tomatoes did she can?

I Bill and David timed themselves when they picked strawberries. It took Bill 5 minutes to pick a box of berries. It took David 10 minutes. It took David how many times as long as Bill to pick a box of strawberries?

J Bill White is 9 years old. His brother Jim is 18 years old. Jim is how many times as old as Bill?

K Jim is how much older than Bill?

L Bill said that they had a horse named Peg that was 20 years old and a horse named Tony that was 5 years old. Peg was how many times as old as Tony?

M Tony was how much younger than Peg?

N David rode Tony for 20 minutes each day he was on the farm. David was on the farm for 4 days. He spent how many minutes in all riding Tony?

Now you should be able to find how many times as large one group is as another group. 1

Keeping skillful

2

A	$81 \div 9 = \square$
B	$63 \div 7 = \square$
C	$40 \div 5 = \square$
D	$72 \div 8 = \square$
E	$54 \div 9 = \square$
F	$64 \div 8 = \square$
G	$42 \div 6 = \square$
H	$56 \div 7 = \square$
I	$48 \div 8 = \square$
J	$54 \div 6 = \square$
K	$72 \div 9 = \square$
L	$45 \div 5 = \square$

3

A	$72 \times 5 = \square$
B	$46 \times 2 = \square$
C	$7 \times 85 = \square$
D	$3 \times 209 = \square$
E	$417 \times 8 = \square$
F	$6 \times 530 = \square$
G	$14 \times 63 = \square$
H	$32 \times 89 = \square$
I	$28 \times 53 = \square$
J	$56 \times 171 = \square$
K	$83 \times 426 = \square$
L	$59 \times 308 = \square$

3

A	$\square + 431 = 609$
B	$718 - 216 = \square$
C	$536 - \square = 94$
D	$18 \times 703 = \square$
E	$628 + 75 + 290 = \square$
F	$2354 + \square = 6179$
G	$\square - 860 = 448$
H	$3000 - 2410 = \square$
I	$26 + 65 + 85 = \square$
J	$9 \times 240 = \square$
K	$\square - 217 = 529$
L	$\square + 4892 = 7930$

172

1 Draw attention to the groups of 2 tadpoles. Let the children note that there are 5 such groups. Have them do the computation. Be sure they know that the answer tells how many times as many tadpoles there are as turtles.

2 Write the equation for Problem A on the board. Be careful to see that the pupils understand what each number in the equation stands for—in particular, that the 3 stands for a group of yellow chicks equal in number to the black chicks.

3 Proceed in the same way with Problem B, first building the equation and having the children discuss each number in it.

4 Let the children try Problems C and D to see if they can do them.

5 Have the children work independently on Problems E to N (G to N are on page 173) without prior discussion.

173

1 Discuss any problems with which the children have had difficulty, and talk about the equation for each to make clear what the numbers in it mean.

2 Use these exercises first orally; then have the children write their responses.

3 Have the children work these examples and then supply answers so that the children can verify their work.

174-175 Using arithmetic

Exponded Notes ore not considered necessory for this lesson.

Objectives

The child solves problems of the types he has studied so far in this program.

Vocabulary

New words page 174 skating*, who*, rented, horseshoes*, swimming*, deep*; Page 175 bicycles*

Comments

The work on pages 174 and 175 provides experience in problem solving, including making equations, selecting the correct arithmetical process to use, and computing. As with other lessons of this kind, it is advisable to let the children work the problems independently before there has been any general discussion of them. This makes the problems much more challenging for the child and forces him to think through each problem for himself. It also shows you how he thinks about the problems and reveals any difficulties he might have with certain problem types. Always require the children to make an equation for each problem with a screen for the unknown number. The computation should then be done and the equation rewritten with the missing number supplied. After the problems have been checked, discuss any that caused difficulty.

Answers

A $24-8=[16]$
B $16\div8=[2]$
C $16-5=[11]$
D $5\times25¢=[\$1.25]$
E $11\times50¢=[\$5.50]$
F $15\times35¢=[\$5.25]$
G $12\div3=[4]$
H $27\div3=[9]$
I $12\div4=[3]$
J $18\times25¢=[\$4.50]$
K $18+14=[32]$
L $24\div8=[3]$
M $32-[21]=11$
N $10\div2=[5]$
O $13-6=[7]$
P $[65]-38=27$
Q $18\div[9]=2$
R $27\times15¢=[\$4.05]$
S $27-19=[8]$
T $[5]+7=12$

Using arithmetic 1

A 24 children went roller skating. 8 of them had roller skates. The others did not have skates. How many children did not have roller skates?

B The number of children without skates was how many times the number of children with roller skates?

THINK Why do you use 16 and 8?

C The children who did not have skates rented some. 5 of these children used the skates for just one hour. The others who rented skates used them for 2 hours. How many children rented skates for 2 hours?

D Skates rented for 25¢ an hour. How much did those children who rented skates for 1 hour pay altogether for the use of the skates?

E Those children who rented skates for 2 hours paid 50¢ apiece. How much did these children pay altogether for the use of the skates?

F 15 children took a boat ride. The ride cost 35¢ for each person. How much did all of the children who took the boat ride have to pay?

G 12 boys played marbles. 3 boys played in each ring. How many rings were there?

H 4 boys played horseshoes. The distance from one post to the other was 27 ft. How many yards was this?

I The number of boys who played marbles was how many times the number of boys who played horseshoes?

THINK From which problems do you get the numbers you need?

J 18 children were swimming in the pool. Each child had paid 25¢ to swim in the pool. How much altogether did it cost these children to swim in the pool?

K In the afternoon 14 more children came to the pool. How many children were using the pool then?

L 24 boys and 8 girls were swimming in the pool. The number of boys was how many times the number of girls?

M Some of the children who were swimming went home. Then only 11 children were left in the pool. How many children went home?

N The water at one end of the pool was 10 ft. deep. At the other end the water was 2 ft. deep. The water at the deep end was how many times as deep as the water at the other end?

174

1 Ask the children to work Problems A to T (O to T are on page 175). Direct them first to write an equation with the screen for the unknown number, then to rewrite it with the answer. If they need to write the numbers in computational form to find the answers, this work should also be shown. Have them label their problems with the identifying letters used in the book.

O 13 girls were making presents for their friends. 6 of them were stringing beads, and the rest were making pins. How many girls were making pins?

P Sue had some beads to use for stringing. After using 38 of them, she found she had 27 beads left. How many beads did Sue have at first?

Q 18 children were riding ponies. They rode in 2 groups. How many children were riding in each group?

R 27 children paid 15¢ an hour to rent bicycles. How much did they all pay to rent the bicycles for 1 hour?

S 19 of the children who rented bicycles left. The others were still riding their bicycles. How many children were still riding bicycles?

T Tony and Jim were making puppets for a show. They made some puppets before lunch and 7 more after lunch. Altogether they made 12 puppets. How many did they make before lunch? 1

Keeping skillful

A $263 \times \$.78 = ■$

$$\begin{array}{r} 263 \\ \$.78 \\ \hline 21.04 \\ 184.10 \\ \hline \$205.14 \end{array}$$

It is easier to multiply by the smaller number.

Remember to put the point and dollar sign in the answer.

B $584 \times \$.09 = ■$

$$\begin{array}{r} 584 \\ \$.09 \\ \hline \$52.56 \end{array}$$

A $26 \times \$.07 = ■$
B $49 \times \$1.48 = ■$
C $274 \times \$.11 = ■$
D $829 \times \$.05 = ■$
E $692 \times \$.14 = ■$
F $2 \times \$.76 = ■$
G $58 \times \$.02 = ■$

A $■ + \$.37 = \$1.18$
B $\$4.35 - ■ = \$.95$
C $575 \times \$.07 = ■$
D $\$.68 + \$3.49 = ■$
E $■ - \$.55 = \$1.10$
F $226 \times \$.85 = ■$
G $\$4.30 - \$2.86 = ■$

H $85 \times \$.04 = ■$
I $■ + \$.17 = \$.35$
J $\$4.17 - \$.70 = ■$
K $\$6.92 + \$9.64 = ■$
L $■ - \$7.83 = \$2.17$
M $\$5.06 + ■ = \$9.00$
N $419 \times \$.45 = ■$

175

175

1 Provide the children with answers, and let them verify their work on Problems A to T (Problems A to N are on page 174). When they have finished, let them take turns reading each problem and describing the situations in their own words. They should be able to explain each number and sign in the equation they used. Discuss any problems that caused trouble.

175 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to use the smaller number as the multiplier in multiplication problems involving money, and he practices computing with numbers that involve money.

Vocabulary

There are no new words.

Comments

Children often have difficulty multiplying with numbers that stand for money, especially when the smaller number is the one that represents dollars and cents. Traditionally, the number with the dollar sign and point has been used for the multiplicand, but it is much easier to multiply by the smaller number, whichever it is. All that is necessary is for the number that represents money to be properly labeled and marked as dollars and cents. Since the child has learned that in any multiplication situation it is possible to use the more convenient number for the multiplier, it should be easy for him to apply this knowledge to computation with money. He should understand that the number that represents dollars and cents can be used either as multiplier or as multiplicand and that he should set up his computation in the easier way, just as he would with any other multiplication problem.

Answers

(block 1)

A $1.82
B $72.52
C $30.14
D $41.45
E $96.88
F $1.52
G $1.16

(block 2)

A $.81
B $3.40
C $40.25
D $4.17
E $1.65
F $192.10
G $1.44

H $3.40
I $.18
J $3.47
K $16.56
L $10.00
M $3.94
N $188.5

O 13 girls were making presents for their friends. 6 of them were stringing beads, and the rest were making pins. How many girls were making pins?

P Sue had some beads to use for stringing. After using 38 of them, she found she had 27 beads left. How many beads did Sue have at first?

Q 18 children were riding ponies. They rode in 2 groups. How many children were riding in each group?

R 27 children paid 15¢ an hour to rent bicycles. How much did they all pay to rent the bicycles for 1 hour?

S 19 of the children who rented bicycles left. The others were still riding their bicycles. How many children were still riding bicycles?

T Tony and Jim were making puppets for a show. They made some puppets before lunch and 7 more after lunch. Altogether they made 12 puppets. How many did they make before lunch?

Keeping skillful

A $263 \times \$.78 = ■$

263
$.78 ← It is easier to multiply by the smaller number.
21.04
184.10 Remember to put the point and dollar sign in the answer.
$205.14 ← sign in the answer.

B $584 \times \$.09 = ■$

2
584
$.09
$52.56

A $26 \times \$.07 = ■$
B $49 \times \$1.48 = ■$
C $274 \times \$.11 = ■$
D $829 \times \$.05 = ■$
E $692 \times \$.14 = ■$
F $2 \times \$.76 = ■$
G $58 \times \$.02 = ■$

A $■ + \$.37 = \$1.18$
B $\$4.35 - ■ = \$.95$
C $575 \times \$.07 = ■$
D $\$.68 + \$3.49 = ■$
E $■ - \$.55 = \$1.10$
F $226 \times \$.85 = ■$
G $\$4.30 - \$2.86 = ■$

4

H $85 \times \$.04 = ■$
I $■ + \$.17 = \$.35$
J $\$4.17 - \$.70 = ■$
K $\$6.92 + \$9.64 = ■$
L $■ - \$7.83 = \$2.17$
M $\$5.06 + ■ = \$9.00$
N $419 \times \$.45 = ■$

175

175

1 Discuss this example with the children, and get them to see that it is like any other multiplication example and that either number can be used as multiplier. Point out that they must put the dollar sign and point in the answer.

2 Let them discuss Example B before they go on with the other exercises.

3 Have the children work Exercises A to G and compare their work with answers you provide.

4 Warn the children that in this set of exercises they must sometimes decide whether to add or subtract. When they are through, provide answers so that they can verify their work.

176-178 Exploring problems

Expanded Notes for this lesson are on pages 308-309.

Objectives

The child learns what remainders in divisive situations mean.

Vocabulary

New words page 178 drink*, carton, calendar, born*, date, wrote, April, July, January, September

Comments

In this lesson children learn to interpret the remainders in divisive situations when they are finding the number of equal groups and when they are finding the size of equal groups. They must learn that in both cases the remainders stand for whatever objects they have been dividing. If they are dividing 59 peaches into equal groups of 6, they will get 9 groups of 6 peaches and a remainder of 5 peaches; and if they divide the same 59 peaches into 9 equal groups, there will be 6 peaches in each group and again a remainder of 5 peaches.

Before presenting this lesson, in which both situations involving division are used, it might be well to review the work on finding the size of equal groups on pages 120 to 123, since this is the division situation with which the children have had the least experience.

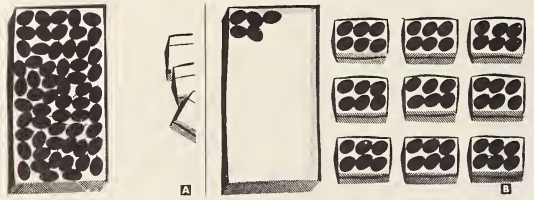
In the problems on page 176 the children must find the number of equal groups, on page 177 they find the size of the equal groups, and on page 178 there are problems of both types, all with remainders.

Answers

Page 178:

A $27 \div 6 = [4]$ and 3 rm. 3 other cans.
B $31 \div 6 = [5]$ and 1 rm. 1 other can.
C $65¢ \div 9¢ = [7]$ and 2¢ rm. 2¢ in change.
D $35¢ \div 8¢ = [4]$ and 3¢ rm. 3¢ in change.
E $51 \div [6] = 8$ and 3 rm.
F $18¢ \div 5¢ = [3]$ and 3¢ rm.

Exploring problems



A A grocer had 59 peaches. He made as many baskets of 6 peaches as he could. How many baskets did he make? How many peaches were left over?

1

$59 \div 6 =$ ☐ You must find this number.

In Picture B the 59 peaches are divided into groups of 6.
$59 \div 6 = 9$ and ■ remainder.

2 There are ■ groups of 6 peaches. There are 5 peaches left over.

B The grocer wanted to put 27 cans of soup into piles of 6 cans each. How many piles could he make? How many cans would be left over?

3

THINK $27 \div 6 =$ ■ and ■ remainder. He could make ■ piles. ■ cans would be left over.

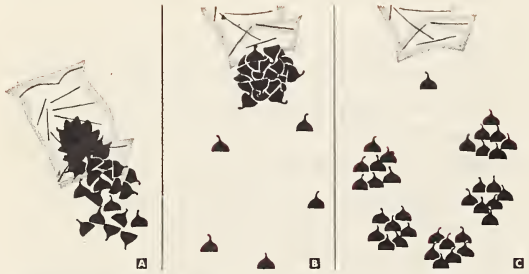
C Candy bars cost 5¢ each. John had 24¢ to spend. How many bars could he buy? How many cents would be left? **4**

THINK $24 \div 5 =$ ■ and ■ remainder. He could buy ■ candy bars. He would have ■¢ left over.

D Tony's mother sent him to the store to buy 50¢ worth of rolls. The rolls cost 6¢ each. How many rolls could Tony buy? How much money would he have left?
$50 \div 6 =$ ■ and ■ remainder

E Cat food cost 9¢ a can. How many cans of food could Peggy buy for 40¢? How much money should the grocer give her in change?

THINK When you divide in Problem E, the remainder tells you how much money Peggy should get in change.



A Five boys bought a bag of candy and counted the pieces so that they could share them equally. There were 36 pieces in the bag. How many pieces could each boy have? How many pieces were left over?

1

$36 \div$ ■ $= 5$ You must find this number.

Look at Picture B. The boys put the pieces in 5 equal groups.

2 Each time they took 1 candy apiece, they took a group of 5 candies. You can say that they divided the pieces into groups of 5.

Now look at Picture C. Each boy got 7 pieces of candy. One piece of candy was left over.

3 $36 \div 5 = 7$ and ■ remainder

B The grocer had 37 cans of fruit. He wanted to put them in 6 piles, with the same number of cans in each pile. How many cans should he have put in each pile? How many cans would be left over? **4**
$37 \div$ ■ $= 6$ Divide 37 by 6.

C He also wanted to put 45 cans of tomatoes in 7 piles, with the same number of cans in each pile. How many cans should he have put in each pile? How many cans would be left over?
$45 \div$ ■ $= 7$ Divide 45 by 7.

D One afternoon the grocer had 22 bananas left. 4 people wanted to buy them. If they shared the bananas equally, how many could each person buy? How many bananas would be left?
$22 \div$ ■ $= 4$ Divide 22 by 4.

176

1. Direct the children to read the problem, look at the equation, and then relate both problem and equation to Pictures A and B.
2. Have the children discuss these statements and relate them to Picture B. Be sure they understand that the peaches were divided into as many groups of 6 as possible, and that the remainder represents the peaches that were left over because there were not enough of them to make another group of 6.
3. Work with Problem B in the same way you did with Problem A. It may be helpful to use small objects to represent the cans and show the children how the division is done. Make clear to them that, since they are dividing cans, the remainder will be cans.
4. Use the above techniques with Problems C, D, and E.

177

1. Direct the children to read the problem, look at the equation, and relate both to Picture A.
2. Discuss these statements and have pupils relate them to Picture B. Emphasize that when each of the five boys takes a piece of candy, a group of 5 pieces has been removed, and that this is the same as dividing by 5. Get them to note that in Picture B the first group of 5 removed has been arranged with one piece in a place for each boy.
3. Relate these statements to Picture C. Get the children to see that each of the five boys has been able to take a piece of candy and put it in his pile seven times, that there are five piles of 7 pieces of candy, and that 1 piece of candy is left. Relate this picture to the equation.
4. Use techniques similar to those used for Problem A with Problems B, C, and D. If necessary, let pupils use objects to show how to work out the problems.

A Mrs. Young bought 27 cans of fruit drink. The cans came in cartons of 6. How many cartons did she buy? How many other cans did she buy?

THINK When you divided, did the remainder tell you how many other cans Mrs. Young bought?

B Mrs. Wall bought 31 cans of fruit drink. How many cartons of 6 did she buy? How many other cans?

C Mrs. Wall saw some large peaches that cost 9¢ each. How many of these peaches could she buy for 65¢? How much money should she get in change?

D Large oranges cost 8¢ apiece. How many of these oranges could Mrs. Young buy for 35¢? How much money should she get in change?

E The grocer had 51 oranges to put into 8 bags. He put the same number of oranges into each bag and used as many of the 51 oranges as he could. How many oranges did he put into each bag? How many oranges were left over?

F Lollipops cost 5¢ each. How many lollipops could Peggy buy for 18¢? How much money should she have left?

Now, when you divide, you should understand what the remainder means.

2

Side trip

3

APRIL 1947						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	(18)	19
20	21	22	23	24	25	26
27	28	29	30			

John's way 4-18-47

Tom's way 4/18/47

A The ring on the calendar shows when John was born. Look at his way of writing this date. He wrote 4 because April is the fourth month. Why did he write 18 and 47?

B How is Tom's way of writing this date different from John's?

C When were you born? Write the date in two ways.

Write each of the dates below in two ways.

5

D June 3, 1952 6-[ ]-[ ] 6/[ ]/[ ]

E July 26, 1955 7-[ ]-[ ] 7/[ ]/[ ]

F May 22, 1956

G January 1, 1949

H March 23, 1904

I September 30, 1951

178

178

1 Ask the children to work Problems A to F. Direct them to write the equation with the screen for the missing number, compute, and write the completed equation. Warn them that they must decide for each problem whether they are to find the number of equal groups or the size of the equal groups, and to decide what the remainder means.

2 Supply the pupils with equations and answers and let them verify their work. Discuss any problems that caused trouble.

3 Discuss the calendar with the children. Get them to observe and interpret the initials for the days of the week, the sequence of numbers, etc.

4 Direct attention to the circle around the 18 and read and discuss Exercise A and the two ways shown of writing this date. Read and discuss Exercises B and C.

5 Have the children write each date in Exercises D to I in two ways.

179 Thinking straight

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to round off large numbers to the nearest ten thousand, hundred thousand, or million. He also learns to round off numbers in the most convenient way for arranging them in order of size.

Vocabulary

New words page 179 populations, cities*, size*, Los Angeles

Comments

This lesson is another step in getting children to understand and accept numbers that have been rounded off or that are approximations rather than exact amounts. It might be well to review page 97, where rounding off numbers was introduced, before proceeding with the new material on this page.

It is important that children have some reason for rounding off numbers and that they understand that the way in which a number is rounded off is determined by the use to which the number is put. If, for example, they wish to remember the approximate populations of several large cities, rounding off to the nearest million is both convenient and adequate. But if this same group of cities were to be put in order of population size, the rounded figure might have to be much closer to the precise figure.

Children also need some experience in deciding when rounding off is useful and when it is not. Tell them that a round number is often easier to remember. Ask them to give various distances, such as the number of blocks from their homes to the school, the number of blocks from where they live to the center of town or the main shopping section, the distance to the next town, etc., and discuss with them whether or not it is possible to get a reasonably good idea of these distances if they are given approximately, or rounded off. Let them suggest other situations in which rounding off is or is not useful.

Remind them that we do not approximate some things. Ask them if people should try to remember their telephone numbers or license plate numbers by rounding them off.

The "Keeping skillful" lesson at the bottom of the page provides practice with division basic facts.

Answers

A Yes. Because there are too many figures that must be remembered in each number.

B Yes. Because there is only one figure that must be remembered in each number.

C Because 2,839,270 is very close to 3 million; 2 million would be almost 1 million less than the actual population.

D No. Because Detroit, Los Angeles, and Philadelphia appear to have the same population and so do London and New York.

E Yes

F When Don rounded off the population to the nearest hundred thousand, he looked at the 970,358 in 1,970,358 and saw that 970,358 is almost 1 million.

G (Have pupils give reasons for the degree of rounding off they do.)

H To write these cities in the order of their size, it is necessary to use the populations as they are given or to round them off to the nearest hundred. Rounding to the nearest hundred, they become:

64,400	51,100	97,200
96,800	63,800	94,100

Thinking straight

	1950 population	John 2	Don 4
Bombay	2,839,270	3,000,000	2,800,000
Chicago	3,620,962	4,000,000	3,600,000
Detroit	1,849,568	2,000,000	1,800,000
London	8,346,137	8,000,000	8,300,000
Los Angeles	1,970,358	2,000,000	2,000,000
Montreal	1,395,400	1,000,000	1,400,000
New York	7,891,957	8,000,000	7,900,000
Philadelphia	2,071,605	2,000,000 3	2,100,000

1 A Betty looked up the populations of the large cities given above. Would it be hard for you to remember these populations? Why?

B John rounded off each population to the nearest million. Is it easier to remember the populations that John has written? Why?

C Why did John round off the population of the first city to 3,000,000 and not to 2,000,000?

D Can you use John's figures to write the cities in the order of their size? Why?

E Don rounded off each population to the nearest hundred thousand. Can you use Don's figures to write the cities in the order of their size?

F Both John and Don rounded off the population of Los Angeles to 2,000,000. Why?

5 G Here are the populations of 6 cities:

64,430	51,088	97,249
96,815	63,774	94,080

Round off these numbers.

H Can you use your figures to write these cities in the order of their size?

Keeping skillful 6

A	56÷8=■	F	54÷6=■	K	56÷7=■	P	36÷9=■
B	36÷6=■	G	63÷9=■	L	81÷9=■	Q	42÷6=■
C	45÷9=■	H	40÷8=■	M	72÷8=■	R	63÷7=■
D	54÷9=■	I	36÷4=■	N	49÷7=■	S	72÷9=■
E	64÷8=■	J	45÷5=■	O	40÷5=■	T	42÷7=■

179

179

1 Ask the children to read Exercise A. Then direct attention to the table above and discuss why it might be hard to remember these numbers as they are given, and why it might not be important to remember them in this order.

2 Direct attention to John's list and discuss why each figure was rounded off as it was. Use Exercises B and C with this list.

3 Let the children use John's list to try to put the cities in order according to their populations beginning with the largest.

4 Draw attention to Don's list and discuss why he rounded off the numbers as he did. Ask the children to use this list to arrange the cities in order of size. Get them to explain why Don's list is better for this purpose than John's list. Use Exercises E and F with this list.

5 Have pupils write answers for Exercises G and H.

6 These basic facts can be used for both oral and written work.

180-181 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his knowledge of all the problem types learned thus far. He also tests his knowledge of measurement equivalents, division basic facts, and the computational processes.

Vocabulary

New words page 180 later*, grown-ups*

Comments

As with previous lessons of this nature, the purpose of the work on these pages is to check up on the children's progress by means of achievement tests. The first of these tests is on problem solving, and it includes one of each of the kinds of problems taught so far in this program. (You can find these different types of problems listed in the back of this *Teaching Guide* or in the index of the pupils' book.) If any weaknesses are discovered through the use of Test 1, go back and reteach the method of solving problems of the types that caused trouble. In evaluating the work observe both the equation and the computation. If the equation is correct, but the computation incorrect, the child understands the problem but needs more work in computation.

Children should be allowed sufficient time to enable most of them to finish the tests on page 81. By the time the abler students have worked all of the examples in a test, the slower pupils will have completed only five or six of them. You need not feel that the pupils should work all of the examples; the completion of five or six is sufficient to test their ability.

Reteaching chart

Page 180:

Test 1

Problem	Pages	Problem	Pages
A	42-43	H	92-94
B	86-87	I	134-137
C	88-90	J	130-133
D	28-29	K	120-123
E	170-173	L	86-87
F	52-53, 167, 175	M	66-67
G	52-53, 154-156, 175	N	28-29

Page 181:

Test	Pages	Test	Pages
2	10, 91, 109	5	147-153, 159-160, 161-164
3	20-23, 24-27		
4	36-41, 45, 54	6	60-65, 105-107, 114-117

Exercise	Test 7	Test 8
A	92-94, 36-41	130-133, 36-41
B	20-23	36-41
C	24-27	130-133, 36-41
D	88-90, 36-41	134-137, 24-27
E	92-94, 36-41	36-41
F	88-90, 36-41	134-137, 24-27
G	88-90, 36-41	130-133, 36-41
H	92-94, 36-41	36-41
I	24-27	134-137, 24-27
J	88-90, 36-41	

Exercise	Test 9	Test 10
A	105-107	24-27
B	105-107, 120-123	161-164
C	60-65	24-27, 134-137
D	60-65	114-117, 120-123
E	114-117, 120-123	114-117
F	60-65, 120-123	36-41
G	55-59	36-41, 88-90
H	60-65, 120-123	36-41, 92-94
I	60-65	24-27, 134-137

Answers

Page 180:

A $156-65=[91]$
B $82-74=[8]$
C $32+[33]=65$
D $16+8=[24]$ or $8+16=[24]$
E $20¢\div 5¢=[4]$
F $125\times 20¢=[\$25.00]$
G $86\times 5¢=[\$4.30]$
H $[\$1.40]+\$5.60=\$7.00$
I $[45¢]-8¢=37¢$
J $38¢-[23¢]=15¢$
K $40¢\div[5¢]=8$
L $30¢-25¢=[5¢]$
M $35¢\div 7¢=[5]$
N $\$.35+\$.40+\$.40=[\$1.15]$

Page 181:

Test 2	Test 3	Test 4	Test 5
A 240	A 382	A 467	A 25,515
B 108	B 104	B 823	B 513
C 9	C 809	C 606	C 3700
D 9	D 1027	D 2046	D 7392
E 105	E 94	E 558	E 24,514

Test 2	Test 3	Test 4	Test 5
F 8	F 203	F 35	F 35,206
G 240	G 780	G 3726	G 2534
H 3	H 870	H 75	H 7740
I 180	I 1113	I 707	I 14,674
J 112	J 208	J 477	J 1500

Test 7	Test 8	Test 10
A 274	A 83	A 605
B 213	B 797	B 19,890
C 1628	C 90	C 456
D 70	D 1415	D 8
E 446	E 241	E 8
F 117	F 1266	F 29
G 579	G 203	G 276
H 558	H 439	H 15
I 1531	I 718	I 508
J 189		

Checking up

1

Test 1

A 156 children saw the school play. 65 children saw it in the morning. The others saw it in the afternoon. How many children saw the school play in the afternoon?

B 82 of the children who saw the play were girls. 74 were boys. How many more girls than boys saw the play?

C In the morning 32 children came to the play at first. More children came in later. Then there were 65 children at the play. How many children came in later?

D Sixteen boys and eight girls were in the play. How many children were in the play?

E The play was given a third time in the evening. Tickets for grown-ups cost 20¢. Tickets for children cost 5¢. A ticket for a grown-up cost how many times as much as a ticket for a child?

F 125 grown-ups saw the play. At 20¢ each, how much did their tickets cost altogether?

G Eighty-six children saw the play in the evening. At 5¢ each, how much did their tickets cost altogether?

H Mary sold fruit drinks during the evening. When she started, she had some money to make change. She sold $5.60 worth of fruit drinks. Then she had $7. How much money did she have to make change when she started?

I Tony had some money to spend. He spent 8¢ for a fruit drink, and then he had 37¢ left. How much money did he have at first?

J Peggy came to the play with 38¢. She bought ice cream and a fruit drink. Then she had 15¢ left. How much money had she spent?

K Carol bought ice-cream cones for herself and 7 friends. She spent 40¢ for them. How much did each of the 8 ice-cream cones cost?

L David spent $.25 at the play, and Tom spent $.30. David spent how much less than Tom?

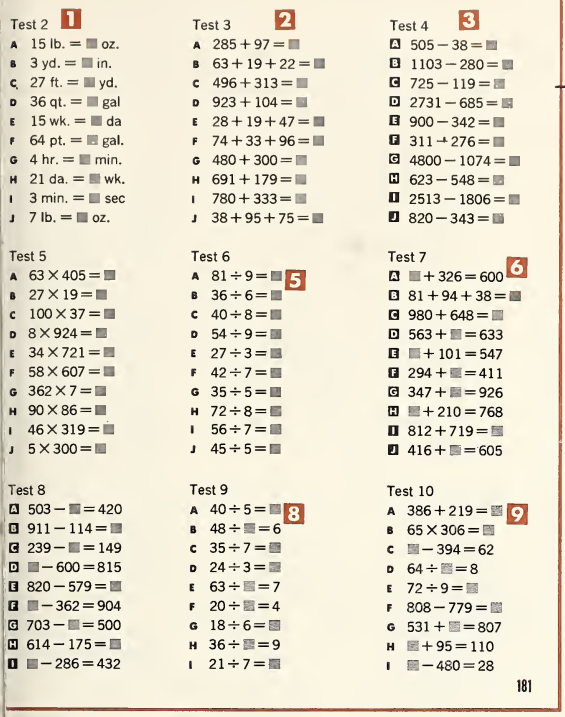
M John paid 35¢ for some dishes of ice cream. Each dish cost 7¢. How many dishes of ice cream did he buy?

N Nancy spent $.35, Jane spent $.40, and Carol spent $.40. How much in all did these 3 girls spend?

2

1 Give this test to the children without timing them. Direct them to make an equation for each problem, putting a screen where the missing number should be, then to do the computation, and, finally, rewrite the equation with the answer in it.

2 Give the children the correct answers and let them verify their work. Find out which problems the children had difficulty with and do whatever reteaching is necessary. Use the Reteaching Chart.



Test 2 1

A 15 lb. = ■ oz.
B 3 yd. = ■ in.
C 27 ft. = ■ yd.
D 36 qt. = ■ gal
E 15 wk. = ■ da
F 64 pt. = ■ gal.
G 4 hr. = ■ min.
H 21 da. = ■ wk.
I 3 min. = ■ sec
J 7 lb. = ■ oz.

Test 3 2

A 285 + 97 = ■
B 63 + 19 + 22 = ■
C 496 + 313 = ■
D 923 + 104 = ■
E 28 + 19 + 47 = ■
F 74 + 33 + 96 = ■
G 480 + 300 = ■
H 691 + 179 = ■
I 780 + 333 = ■
J 38 + 95 + 75 = ■

Test 4 3

A 505 − 38 = ■
B 1103 − 280 = ■
C 725 − 119 = ■
D 2731 − 685 = ■
E 900 − 342 = ■
F 311 − 276 = ■
G 4800 − 1074 = ■
H 623 − 548 = ■
I 2513 − 1806 = ■
J 820 − 343 = ■

Test 5

A 63 × 405 = ■
B 27 × 19 = ■
C 100 × 37 = ■
D 8 × 924 = ■
E 34 × 721 = ■
F 58 × 607 = ■
G 362 × 7 = ■
H 90 × 86 = ■
I 46 × 319 = ■
J 5 × 300 = ■

Test 6 5

A 81 ÷ 9 = ■
B 36 ÷ 6 = ■
C 40 ÷ 8 = ■
D 54 ÷ 9 = ■
E 27 ÷ 3 = ■
F 42 ÷ 7 = ■
G 35 ÷ 5 = ■
H 72 ÷ 8 = ■
I 56 ÷ 7 = ■
J 45 ÷ 5 = ■

Test 7 6

A ■ + 326 = 600
B 81 + 94 + 38 = ■
C 980 + 648 = ■
D 563 + ■ = 633
E ■ + 101 = 547
F 294 + ■ = 411
G 347 + ■ = 926
H ■ + 210 = 768
I 812 + 719 = ■
J 416 + ■ = 605

Test 8

A 503 − ■ = 420
B 911 − 114 = ■
C 239 − ■ = 149
D ■ − 600 = 815
E 820 − 579 = ■
F ■ − 362 = 904
G 703 − ■ = 500
H 614 − 175 = ■
I ■ − 286 = 432

Test 9 8

A 40 ÷ 5 = ■
B 48 ÷ ■ = 6
C 35 ÷ 7 = ■
D 24 ÷ 3 = ■
E 63 ÷ ■ = 7
F 20 ÷ ■ = 4
G 18 ÷ 6 = ■
H 36 ÷ ■ = 9
I 21 ÷ 7 = ■

Test 10 9

A 386 + 219 = ■
B 65 × 306 = ■
C ■ − 394 = 62
D 64 ÷ ■ = 8
E 72 ÷ 9 = ■
F 808 − 779 = ■
G 531 + ■ = 807
H ■ + 95 = 110
I ■ − 480 = 28

181

181

1 This is a test on measurement equivalents. Direct the children to write the missing numbers.
2 This test is on addition.
3 This is a test on subtraction.
4 This is a test on multiplication with one-figure, two-figure, and three-figure numbers.
5 This is a test on division basic facts with dividends of 27 to 81.
6 This is a test on solving different types of equations arising from additive problem situations.
7 This is a test on solving different types of equations arising from subtractive problem situations.
8 This is a mixed test on division basic facts. In some of the exercises the child must find the size of the equal groups, and in some he must find the number of equal groups.
9 This is a test on all four processes.

182-191 Learning how

Expanded Notes for this lesson are on pages 311-314.

Objectives

The child learns how to divide when the answer has two figures and the divisor has only one figure.

Vocabulary

New words page 182 bulbs, pans*, us*; page 184 full*, again*

Comments

Most teachers will readily admit that teaching the process of division is one of the most difficult tasks they have in arithmetic. Children seem to get along fairly well as long as they are required to work only with one-figure divisors. But as soon as two-figure divisors enter the picture, the real troubles begin.

In an attempt to eliminate these difficulties, certain changes have been introduced in the teaching of division during the past twenty years. The division process is now customarily introduced by the "long-division" instead of the "short-division" method. The long-division method was introduced with one-figure divisors in the belief that it would contribute to the understanding of the way the child would have to divide with two-figure divisors. In replacing the short-division method by the long-division method, it was felt, too, that children would no longer have the problem of having to rely so much on remembering numbers.

The long-division method for doing division with one-figure divisors—the method by which all stages of thinking are written down—is used in this book. But certain innovations will, the authors believe, bring about a better understanding of the process of long division, which in turn should make the study of long division with divisors of two figures and three figures much easier.

The importance of helping the child understand what he is doing at every step leads to a new arrangement of the work. Teachers should remember that the arrangement now commonly used was not introduced until comparatively modern times and is not widely used

outside our country. The decision as to what is a good arrangement of numerical work on paper depends upon several factors, and one of these is the way the arrangement helps or hinders an understanding of the process.

The new arrangement of work differs in only a few ways from what has been done in the past. Partial quotients (numbers that will be combined cumulatively to make the answer) are put at the right in a column. The final answer, which is their total, is put at the bottom of this column instead of above the dividend (the number to be divided). The arrangement is used so that each of the partial quotients can be written out in full, and not just one figure of the number, as has been customary. When the child thinks of 10, he writes 10; when he thinks of 200, he writes 200, not just the figure 2. Moreover, the traditional method requires the child to find the maximum partial quotient at each step. With the new arrangement, however, the child can use several partial quotients that are smaller than the maximum partial quotient, but which can be combined by addition to produce the maximum partial quotient. This enables the child to work within the limits of his ability much better than the old method. As the study of division continues through the next two grades, the child's thinking will be guided so that he will be able to improve his estimates of the partial quotients.

In this program, the child is permitted to write complete numbers in all parts of the computation. (See Step B, page 185.) That is, instead of having him "subtract 4 from 5," as he would in the old method, he subtracts 40 from 54. He writes the numbers so that they describe the situation as it actually is. This enables him to understand the reasons for each step of the process.

The amount that remains to be divided each time (see the 34 in Steps D, E, and F, page 183) is shown completely, not in fragments. This helps the child to think of the division process as it really is—a process of repeated subtraction.

Pictures are provided for each step of the process for each problem. Great care has been taken to correlate the numbers in the computation with them. The child has a complete guide to aid his thinking as he is learning.

Note that on pages 190 and 191 four ways in which the child's work might be arranged are shown under the TRY step. The fourth way is shown as the most precise, efficient way to do the computation.

The explanation of division begins with a problem involving a remainder so that the children can see the whole picture of division at once.

Terms such as *dividend, quotient, partial quotient,* and *partial dividend* are likely to be confusing to children, and are not used in the text. You will probably want to avoid using them yourself, and you should not require their use by the children.

The four-step teaching method is used in presenting this new material.

Answers

Page 191:

(block 1)

A 15	I 82	Q 96
B 14	J 13 and 5 rm.	R 48
C 13 and 6 rm.	K 57 and 3 rm.	S 93 and 3 rm.
D 13	L 35	T 43 and 3 rm.
E 59 and 1 rm.	M 67 and 1 rm.	U 50
F 53 and 1 rm.	N 21 and 1 rm.	V 19 and 3 rm.
G 34 and 3 rm.	O 15	
H 80	P 83	

(block 2)

A 12	H 34	O 60
B 24 and 2 rm.	I 71 and 3 rm.	P 89
C 75 and 2 rm.	J 36	Q 71 and 3 rm.
D 23	K 38	R 10 and 4 rm.
E 75 and 4 rm.	L 16 and 4 rm.	S 66 and 2 rm.
F 71 and 2 rm.	M 66	T 51
G 94	N 14 and 3 rm.	

Learning how

In this lesson you will learn how to divide when the answer has two figures.

see

A

The fourth graders are going to plant 54 flower bulbs in pans. They will put 4 bulbs in a pan. How many pans of 4 bulbs will they have? Will any bulbs be left over? 1

$54 \div 4 = \square$ ← You must find this number.

B

← Let us start with 5 pans of 4 bulbs.

$4\overline{)54}$ 5 ← We will start with 5 groups of 4 bulbs.

3

C

← To fill 5 pans, we will use 5 × 4, or 20 bulbs.

$4\overline{)54}$ 5 ← 5 × 4 = 20.

20 ← We write 20 here so that we can subtract it from 54 to find how many bulbs are left.

5

D

← How many bulbs are left to be put in pans?

$4\overline{)54}$ 5

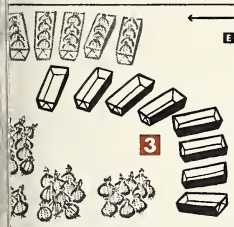
20

34 ← There are 34 bulbs left.

2

E

← Let us try 8 more pans of 4 bulbs.



$4\overline{)54}$ 5

20

34 8 ← We will use 8 more groups of 4 bulbs.

4

F

← This time we used 8 × 4, or 32 more bulbs.

$4\overline{)54}$ 5

20

34 8

32 ← 8 × 4 = 32. We write 32 here so that we can subtract to find how many bulbs are left.

6

Now turn the page.

182

1. Ask pupils to read this problem and the equation without answering the questions or supplying the missing number. Be sure they realize that there are 54 flower bulbs in Picture A and that they are to find out how many groups of 4 bulbs there will be.
2. Direct attention to Picture B. Explain that they do not know how many pans of 4 bulbs they will have, but that they will start with 5 pans.
3. Draw attention to the computation and relate the 5 to the 5 pans. Explain that they are going to use 5 fours first.
4. Explain that a group of 4 bulbs has been put aside for each pan and that there are many bulbs left over. Let the children discover that 20 bulbs are being used.
5. Now direct attention to the computation. Be sure the pupils understand that the 20 is the total of 5 groups of 4 and stands for the 20 bulbs being used. Explain why it is written under the 54.

183

1. Be sure the children observe that the 20 bulbs have been put into pans and that there are 34 bulbs left.
2. Relate the subtraction of 20 from 54 to the removing of the 20 bulbs in the picture. Emphasize that the 34 stands for the number of bulbs left.
3. Draw attention to the 8 new pans and make the point that the children are going to use 8 more groups of 4 bulbs.
4. Relate the 8 to the 8 pans. Make clear that the 8 means that 8 groups of 4 will be used.
5. Note that 8 groups of 4 bulbs have been put aside. Let the children discover that 32 bulbs have been set aside.
6. Be sure the children understand that the 32 is the total of 8 fours. Relate the 32 to the 32 bulbs in the picture. Explain why 32 is written under 34.

There are only 2 bulbs left over.

G

$$\begin{array}{r|l} 4\overline{)54} & 5 \\ 20 & \\ \hline 34 & 8 \\ 32 & \\ \hline 2 & \end{array}$$

2

When we subtract, there is a remainder of 2.

There will be 13 pans of 4 bulbs.

There are 2 bulbs left over.

H

Add 5 and 8.

$$\begin{array}{r|l} 4\overline{)54} & 5 \\ 20 & \\ \hline 34 & 8 \\ 32 & \\ \hline 2 & 13 \end{array}$$

There will be 13 full pans of bulbs. 4

2 bulbs will be left over.

$54 \div 4 = 13$ and 2 remainder

See

We will work the same problem again. 5

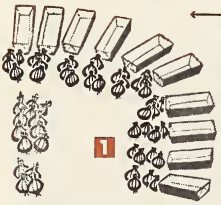
A

$54 \div 4 = \square$

Start with 10 pans of 4 bulbs this time.

$$4\overline{)54} \mid 10$$

We will use 10 fours at first. 6



We will use 10×4, or 40 bulbs.

B

$$\begin{array}{r|l} 4\overline{)54} & 10 \\ 40 & \\ \hline & \end{array}$$

$10 \times 4 = 40$.

We write 40 here so that we can subtract it from 54.

2

14 bulbs are left to be put in pans of 4.

C

$$\begin{array}{r|l} 4\overline{)54} & 10 \\ 40 & \\ \hline 14 & \end{array}$$

4

When we subtract, 14 is left to be divided by 4.

Try 3 more pans of 4 bulbs.

D

$$\begin{array}{r|l} 4\overline{)54} & 10 \\ 40 & \\ \hline 14 & 3 \end{array}$$

Use 3 more fours.

6

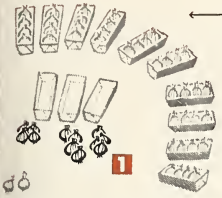
Now turn the page.

184

1. Let the children observe that the bulbs have been put into the 8 pans with 2 bulbs left over.
2. Relate the subtraction of 32 from 34 to the removal of the 32 bulbs from the 34 bulbs in the picture. Be sure the children understand that the 2 stands for the leftover bulbs.
3. Draw attention to the dotted background behind the boxes of bulbs. Explain that it is meant to help them think of the group of 5 pans and the group of 8 pans as one big group of 13 pans. Say, "There will be 13 pans of 4 bulbs each and 2 bulbs left over."
4. Relate the addition of 5 and 8 to the picture. Be sure the children think of the 5 and 8 as 5 groups of 4 and 8 groups of 4 and of the total as 13 groups of 4.
5. Explain that they are going to work the problem again, but that this time they are going to begin with 10 pans of 4 bulbs.
6. Relate the 10 to the 10 pans in the picture. Be sure it is understood to stand for 10 fours.

185

1. Explain that a group of 4 bulbs has been put aside for each of the 10 pans, but that there are still some bulbs left over. Let the children discover that 40 bulbs have been used.
2. Direct attention to the computation. Make sure the children understand that the 40 is the total of 10 groups of 4 and represents the 40 bulbs being used. Have someone explain why it is written under the 54.
3. The children should observe that the 40 bulbs have been put in the pans and that there are 14 bulbs left over.
4. Relate the subtraction of 40 from 54 to the removal of the 40 bulbs in the picture. Emphasize that the 14 stands for the bulbs left.
5. Explain that they will need to use more pans and that they will try 3 more with 4 bulbs each.
6. Relate the 3 to the 3 pans in the picture. Children should realize this 3 means 3 groups of 4.



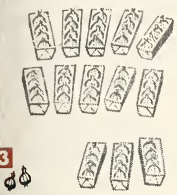
We have used 3×4, or 12 more bulbs.

E

$$\begin{array}{r|l} 4\overline{)54} & 10 \\ 40 & \\ \hline 14 & 3 \\ 12 & \\ \hline 2 & \end{array}$$

$3 \times 4 = 12$. We write 12 here so that we can subtract it from 14.

1 2



How many bulbs are left over?

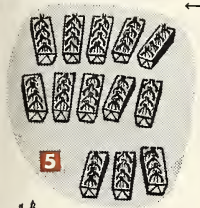
F

$$\begin{array}{r|l} 4\overline{)54} & 10 \\ 40 & \\ \hline 14 & 3 \\ 12 & \\ \hline 2 & \end{array}$$

When we subtract, there is a remainder of 2.

3 4

How many full pans of bulbs will there be?
How many bulbs will be left over?



5

G

Add 10 and 3.

$$\begin{array}{r|l} 4\overline{)54} & 10 \\ 40 & \\ \hline 14 & 3 \\ 12 & \\ \hline 2 & 13 \end{array}$$

6

There are 13 fours.

There is a remainder of 2.

$54 \div 4 = 13$ and 2 remainder

think

A

These 60 bulbs are also going to be planted in pans. There will be 3 bulbs in a pan. How many full pans will there be? Will any bulbs be left over? 1

$60 \div 3 = \square$ You must find this number.

How many pans of 3 bulbs do you try at first?

B

$$3\overline{)60} \quad 10$$

First try ▩ threes.

2

You have used $10 \times$ ▩, or ▩ bulbs.

C

$$\begin{array}{r|l} 3\overline{)60} & 10 \\ 30 & \end{array}$$

How do you get the 30? The 30 shows that you have used ▩ threes.

3

Now turn the page.

186

1. Point out that Picture E shows the 3 groups of 4 bulbs, ready to be put into the pans, and that 12 bulbs in all are being used.
2. Have pupils note where the 12 is written. They should realize that this 12 means 3 groups of 4, or 3×4.
3. Focus attention on the bulbs not used.
4. Make sure the children understand that the subtracting of 12 from 14 shows the removal of the 12 bulbs from the 14 that were in Picture E. Make clear that the 2 stands for the 2 bulbs not used.
5. Explain that the dotted background suggests combining the groups of 10 pans and 3 pans to make a total of 13 pans used in all.
6. Let someone explain how this combining is shown in the computation. Relate the remainder of 2 in the computation to the 2 bulbs left over in the picture. Have someone read the completed equation and relate it to the problem.

187

1. Have pupils read this problem and relate the picture to the 60 bulbs that are to be planted. Call on someone to explain why the equation is correct.
2. Pupils should observe the 10 pans in the picture and realize that 3 bulbs are to be put in each. Then they should relate the 10 in the computation to the 10 groups of 3 that will be made.
3. Pupils should note that 10 groups of 3 bulbs each have been made and that 30 bulbs in all have been used. Call on a pupil to explain which two numbers in the computation are multiplied to make the 30.

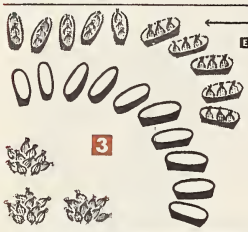
How many bulbs are left to be put in pans of 3?

D

$$3\overline{)60}\ 10$$
$$\underline{30}$$
$$30$$

How do you get this 30? What does this 30 show?

2



Try ■ more pans of 3 bulbs.

E

$$3\overline{)60}\ 10$$
$$\underline{30}$$
$$30\ 10$$

Try ■ more threes.

3

How many bulbs have you used this time?

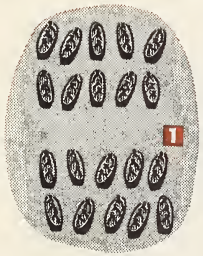
F

$$3\overline{)60}\ 10$$
$$\underline{30}$$
$$30\ 10$$
$$\underline{30}$$

How do you get this 30?

4

188



How many pans of 3 bulbs will there be? Will any bulbs be left over?

G

What do you do now?

$$3\overline{)60}\ 10$$
$$\underline{30}$$
$$30\ 10$$
$$\underline{30}$$
$$20$$

2

What does the 20 mean? Is there a remainder?

$60 \div 3 = ■$

think

You can find the answer for the same problem in this way.

A

3

Try ■ pans of 3 bulbs.

$$3\overline{)60}\ 20$$

Try ■ threes.

Is 20 pans the right answer? How do you know?

B

$$3\overline{)60}\ 20$$
$$\underline{60}$$

How do you get this 60? What does it show?

5

How do you know that you have finished working the problem? What is the answer?

189

188

1. Focus attention on the 30 bulbs still not used.
2. Let a pupil explain the subtraction of 30 from 60 and what the resulting 30 means.
3. Bring out by discussion that the 10 pans were not enough to plant all the bulbs in. Let pupils determine from this picture how many more pans of 3 bulbs each are going to be tried. They should note where the 10 is placed in the computation.
4. After pupils discover that a group of 3 bulbs has been put with each of the 10 pans, ask how many bulbs in all have been used. Be sure they observe that there are no unused bulbs. Let a pupil explain the 30 in the computation.

189

1. The dotted background should indicate to pupils that the two groups of pans are to be combined. They should see that 20 pans with 3 bulbs in each were used in all.
2. Make certain the children relate the tens in the partial answers to the two groups of ten in the picture. They should see that they must add the numbers, just as the groups in the picture had to be combined. Have someone complete the equation and relate it to the original problem and equation.
3. Point out that the answer can be found in a shorter way. Call attention to the picture first and let pupils determine how many pans of 3 bulbs each were tried. They should note where the 20 is placed in the computation.
4. Pupils should see that when 20 pans were used, the 60 bulbs were placed in them in groups of threes, and no bulbs were left over.
5. Have someone multiply 3 by 20. Point out that the problem is solved in one step.

try

A 509 ÷ 8 = ■ **1**

8)509	20
160	
349	40
320	
29	3
24	
5	63

8)509	30
240	
269	30
240	
29	3
24	
5	63

8)509	50
400	
109	10
80	
29	3
24	
5	63

8)509	60
480	
29	3
24	
5	63

509 ÷ 8 = ■ and ■ remainder

B 147 ÷ 3 = ■

3)147	10
30	
117	10
30	
87	20
60	
27	9
27	
	49

3)147	10
30	
117	30
90	
27	9
27	
	49

3)147	20
60	
87	20
60	
27	9
27	
	49

3)147	40
120	
27	9
27	
	49

147 ÷ 3 = ■

C 727 ÷ 9 = ■

9)727	20
180	
547	40
360	
187	20
180	
7	80

9)727	30
270	
457	40
360	
97	10
90	
7	80

9)727	50
450	
277	30
270	
7	80

9)727	80
720	
7	

727 ÷ 9 = ■ and ■ remainder

D 416 ÷ 6 = ■

6)416	10
60	
356	20
120	
236	30
180	
56	9
54	
2	69

6)416	20
120	
296	20
120	
176	20
120	
56	9
54	
2	69

6)416	30
180	
236	30
180	
56	9
54	
2	69

6)416	60
360	
56	9
54	
2	69

416 ÷ 6 = ■ and ■ remainder **1**

do

A The fourth graders had 90 beans to plant. They wanted to put 6 beans in each box. How many boxes did they need?
90 ÷ 6 = ■

B The fourth graders have collected 56 pictures for their flower scrapbook. If they paste 4 pictures on a page, how many pages will they use?
56 ÷ 4 = ■

2

C 110 ÷ 8 = ■
D 91 ÷ 7 = ■
E 119 ÷ 2 = ■
F 160 ÷ 3 = ■
G 173 ÷ 5 = ■
H 400 ÷ 5 = ■
I 574 ÷ 7 = ■
J 83 ÷ 6 = ■
K 231 ÷ 4 = ■
L 70 ÷ 2 = ■
M 403 ÷ 6 = ■
N 85 ÷ 4 = ■
O 135 ÷ 9 = ■
P 664 ÷ 8 = ■
Q 768 ÷ 8 = ■
R 96 ÷ 2 = ■
S 840 ÷ 9 = ■
T 218 ÷ 5 = ■
U 300 ÷ 6 = ■
V 79 ÷ 4 = ■

A 84 ÷ 7 = ■
B 98 ÷ 4 = ■
C 302 ÷ 4 = ■
D 184 ÷ 8 = ■
E 454 ÷ 6 = ■
F 215 ÷ 3 = ■
G 470 ÷ 5 = ■
H 68 ÷ 2 = ■
I 500 ÷ 7 = ■
J 108 ÷ 3 = ■
K 76 ÷ 2 = ■
L 100 ÷ 6 = ■
3 M 330 ÷ 5 = ■
N 129 ÷ 9 = ■
O 420 ÷ 7 = ■
P 356 ÷ 4 = ■
Q 571 ÷ 8 = ■
R 94 ÷ 9 = ■
S 200 ÷ 3 = ■
T 357 ÷ 7 = ■

Now you should be able to divide when the answer has two figures.

190

1 Assign Examples A to D (D is on page 191) as written work. Tell children to put the numbers in the proper computational form and find the answers. Tell them that as they finish each example, they should compare their answer with that in the book. Point out that they must get the same answer, but that their work might look like any one of the four solutions shown, or it might be different.

191

1 When pupils have finished Example D, discuss their work. Let children put on the board the different ways they did their work. Point out that in the book the last solution (the one in red) is the quickest and easiest way to find the answer.

2 Assign Problems A and B and Exercises C to V as written work. Have pupils put examples of their work in solving them on the board. Discuss and bring out the best ways to solve each exercise.

3 Use these exercises with those pupils who need more practice.

192 Thinking straight

Expanded Notes for this lesson are on page 314.

Objectives

The child learns some techniques for finding better numbers to use in getting his answers in division.

Vocabulary

New words page 192 example

Comments

The child should be able to use his knowledge of the division basic facts and of division with remainders in any division situation. For example, if he is going to divide 194 by 3, he should see the 194 as 19 tens, which he can divide by 3 and get 6 tens (60) with 1 ten remainder. The child should learn to look at the first two figures of the number and see it as 19 tens, 32 hundreds, or whatever it may be. Then he can use his knowledge of division basic facts in estimating how many times the divisor is contained in this number.

You may want to have the children discuss each of the problems before doing it. Then let each child work the problem. Afterwards, have the class discuss the finished problems and discover which child had the better solution. The children should then be able to form some generalizations about how to select the most useful numbers in their answers. You should not insist that the children use the techniques shown on this page; each child should divide in the way that he finds easiest.

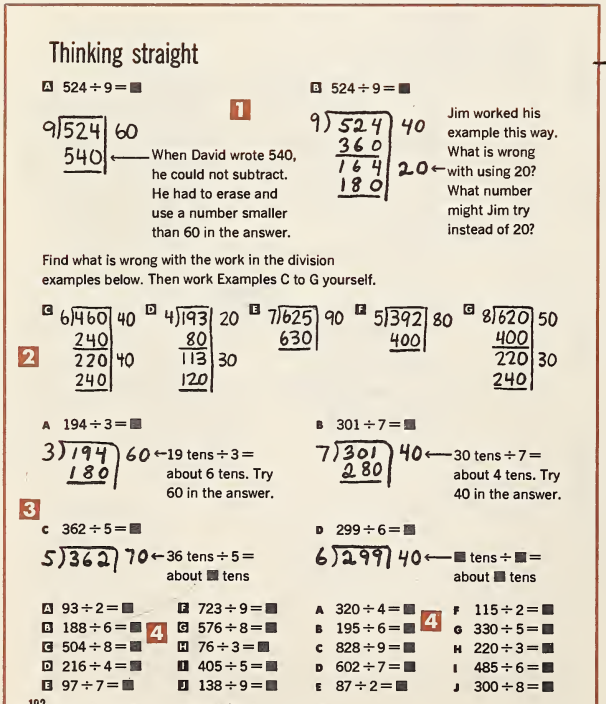
Answers

(block 1)

A 46 and 1 rm.	E 13 and 6 rm.	H 25 and 1 rm.
B 31 and 2 rm.	F 80 and 3 rm.	I 81
C 63	G 72	J 15 and 3 rm.
D 54		

(block 2)

A 80	E 43 and 1 rm.	H 73 and 1 rm.
B 32 and 3 rm.	F 57 and 1 rm.	I 80 and 5 rm.
C 92	G 66	J 37 and 4 rm.
D 86		


Thinking straight
A 524 ÷ 9 = ■
9)524 60
540
When David wrote 540, he could not subtract. He had to erase and use a number smaller than 60 in the answer.
1
B 524 ÷ 9 = ■
9)524 40
360
164
20 ← with using 20? What number might Jim try instead of 20?
Jim worked his example this way. What is wrong
Find what is wrong with the work in the division examples below. Then work Examples C to G yourself.
C 6)460 40
240
220 40
240
D 4)193 20
80
113 30
120
E 7)625 90
630
F 5)392 80
400
G 8)620 50
400
220 30
240
2
A 194 ÷ 3 = ■
3)194 60 ← 19 tens ÷ 3 = about 6 tens. Try 60 in the answer.
180
B 301 ÷ 7 = ■
7)301 40 ← 30 tens ÷ 7 = about 4 tens. Try 40 in the answer.
280
3
C 362 ÷ 5 = ■
5)362 70 ← 36 tens ÷ 5 = about ■ tens
D 299 ÷ 6 = ■
6)299 40 ← ■ tens ÷ ■ = about ■ tens
A 93 ÷ 2 = ■
B 188 ÷ 6 = ■
C 504 ÷ 8 = ■
D 216 ÷ 4 = ■
E 97 ÷ 7 = ■
F 723 ÷ 9 = ■
G 576 ÷ 8 = ■
H 76 ÷ 3 = ■
I 405 ÷ 5 = ■
J 138 ÷ 9 = ■
4
A 320 ÷ 4 = ■
B 195 ÷ 6 = ■
C 828 ÷ 9 = ■
D 602 ÷ 7 = ■
E 87 ÷ 2 = ■
F 115 ÷ 2 = ■
G 330 ÷ 5 = ■
H 220 ÷ 3 = ■
I 485 ÷ 6 = ■
J 300 ÷ 8 = ■
192 Avoiding quotient numbers that are too large. Estimating the quotient number.

192

1 Discuss Examples A and B as a whole, showing how one child used too large a number to begin with, while the other child began with a workable number, but used one that was too large in the next step. Point out that, although there is nothing wrong in using a small number for a partial answer, it is a timesaver to use the largest possible number, and therefore 50 would have been a better number for the first step.

2 Let the children find out what is wrong with each example in this row. Have them work each example correctly. Find a child who used the most economical method to get his answer, and let him show how he worked the example.

3 Explain the estimating method outlined in "Comments" and let the class practice this method in Examples A to D.

4 Assign this block of exercises. When the work is finished, let the pupils decide which choice of partial quotients was most economical.

193-194 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving the types of problems that have been presented so far.

Vocabulary

New words page 193 hot*, roast*, marshmallows; page 194 poured*, lot*

Comments

Let the children work these problems without any preliminary discussion. When they are through, let them help one another with those scattered problems that only a few pupils missed. Spend most of the discussion time on problems that many of the children missed.

It may be necessary in some cases to dramatize the action of the problems and the solutions. Use any convenient number of objects for this purpose, particularly if the numbers in the problem are too large. The purpose of such a dramatization is to give the children an understanding of what took place in the problem; the total situation and the process involved are more important than the numbers employed.

Note that some of the problems use data from preceding problems in their solution. Permit the children to work on these problems without any warning from you. It will be more interesting for them, and it will also give you information about the pupils' ingenuity and ability to work such interdependent problems on their own.

Answers

Using arithmetic:

A $44 \div 4 = [11]$
B $9 + 3 = [12]$ or $3 + 9 = [12]$
C $44 + 12 = [56]$ or $12 + 44 = [56]$
D $160 \div 8 = [20]$
E $150 \div 6 = [25]$
F $25 \times \$.18 = [\$4.50]$
G $160 - 150 = [10]$
H $24 + [12] = 36$
$36 - 14 = [22]$
I $[18] + 12 = 30$
K $4 \times \$.43 = [\$1.72]$
L $7 \times 8 = [56]$
M $7 \times 12 = [84]$
N $30 + 45 = [75]$ or $45 + 30 = [75]$
O $75 \div [15] = 5$
P $15 \times 2 = [30]$
Q $30 + [26] = 56$
R $8 \div 4 = [2]$
S $24 - 15 = [9]$
T $[20] - 14 = 6$
U $56 \div [14] = 4$
V $120 - [112] = 8$
W $44 - 25 = [19]$

Keeping skillful:

(block 1)	(block 2)	(block 3)
A 37 and 1 rm.	A 49	A 1607
B 26 and 2 rm.	B 29	B 584
C 56	C 91	C 1269
D 80 and 3 rm.	D 85	D 864
E 24 and 8 rm.	E 16	E 69
F 22 and 1 rm.	F 33	F 609
G 89 and 4 rm.	G 68	G 240
H 87 and 4 rm.	H 30	H 342
I 40 and 2 rm.	I 85	I 60
J 90 and 1 rm.	J 68	J 5047

Using arithmetic 1

A Forty-four children were having a hot dog roast at the picnic grounds. On the way to the picnic, 4 children rode in each car. How many cars were needed for the children who went to the picnic?

B Nine mothers and 3 teachers went to the picnic, too. How many mothers and teachers were at the picnic?

C How many people were there in all at the picnic?

D Carol's mother brought 160 hot dogs to the picnic. The hot dogs were in packages of 8. How many packages did she bring?

E Jim's mother brought 150 hot dog buns. They were in packages of 6. How many packages of buns did she bring?

F Each package of hot dog buns cost 18¢. How much did all the packages of buns cost?

G How many more hot dogs than hot dog buns did the mothers buy?

H Ann's mother promised to make 36 cupcakes for the picnic. She told Ann the morning before the picnic that she had made 24 cupcakes. How many more did she have to make?

I Ann frosted 14 of the 36 cupcakes. Her mother frosted the rest. How many cupcakes did her mother frost?

J Tom's mother promised to make some cupcakes, too. After she had made 12 chocolate cupcakes, she said, "Now I have made 30 cupcakes." How many did she make before she made the 12 chocolate cupcakes?

K Peggy's mother paid $.43 apiece for 4 packages of marshmallows. How much did all the marshmallows cost?

L Don's mother brought 7 gallons of lemonade to the picnic. How many pints of lemonade was this?

M Mrs. White brought 7 packages of paper cups. There were 12 cups in each package. How many cups were there in the 7 packages?

N At the picnic, the children need about 30 sticks for roasting hot dogs and about 45 more sticks for roasting marshmallows. About how many sticks in all did they need?

O Five children went to find sticks for the hot dogs and marshmallows. If the children were to share the work equally, about how many sticks would each child need to find?

P 15 children began to roast hot dogs on sticks. Each child had 1 stick. They could roast 2 hot dogs on each stick. How many hot dogs could they all roast at one time?

Q How many more hot dogs had to be roasted so that everyone at the picnic could have 1 hot dog?

THINK Problem C tells you how many people were at the picnic. What does Problem P tell you?

R Ann said, "I burned 4 marshmallows and had to throw them away." Jim said that he burned 8. Jim burned how many times as many as Ann?

S "I roasted 24 marshmallows," said Sue, "but we were able to eat only 15 of them. I burned the rest." Sue burned how many marshmallows?

T David gave 14 of the marshmallows he roasted to his friends. He kept 6 for himself. How many marshmallows had David roasted?

U Four children poured 56 cups of lemonade. If each child poured the same number of cups of lemonade, how many cups did each child pour?

V Mrs. Bell said, "We brought 120 cupcakes to our picnic. There are only 8 cupcakes left. We surely ate a lot of cupcakes." How many cupcakes were eaten at the picnic?

W After the picnic, 25 of the children helped pick up papers and put out the fire. The rest of the children helped carry things to the cars. How many children helped carry things to the cars?

1

Keeping skillful

2

A $75 \div 2 = \blacksquare$
B $106 \div 4 = \blacksquare$
C $392 \div 7 = \blacksquare$
D $403 \div 5 = \blacksquare$
E $224 \div 9 = \blacksquare$
F $67 \div 3 = \blacksquare$
G $538 \div 6 = \blacksquare$
H $700 \div 8 = \blacksquare$
I $362 \div 9 = \blacksquare$
J $631 \div 7 = \blacksquare$

3

A $245 \div \blacksquare = 5$
B $87 \div \blacksquare = 3$
C $819 \div \blacksquare = 9$
D $595 \div \blacksquare = 7$
E $96 \div \blacksquare = 6$
F $132 \div \blacksquare = 4$
G $544 \div \blacksquare = 8$
H $60 \div \blacksquare = 2$
I $510 \div \blacksquare = 6$
J $272 \div \blacksquare = 4$

4

A $4316 - 2709 = \blacksquare$
B $8 \times 73 = \blacksquare$
C $641 + 238 + 390 = \blacksquare$
D $4 \times 216 = \blacksquare$
E $207 \div 3 = \blacksquare$
F $83 + 159 + 367 = \blacksquare$
G $48 \times 5 = \blacksquare$
H $600 - 258 = \blacksquare$
I $300 \div 5 = \blacksquare$
J $721 \times 7 = \blacksquare$

193

1 Have the children work independently on Problems A to W (Problems P to W are on page 194). The child should read each problem, write an equation with the screen or square for the missing number, then do the computation, and rewrite the equation with the answer in it. Tell the class that in any problem in which the additive action is imagined, either order of numbers in the equation is acceptable.

194

1 Be sure to spend some time with the problems that caused difficulties, going back, if necessary, to the pages in the book on which such problems were taught.

2 Be sure the children include the remainders in writing their answers.

3 Ask the children how this block of exercises differs from the first one; then have them do the computation.

4 Tell the children to copy these exercises in computational form and then tell them to find the answers.

195-197 Exploring problems

Expanded Notes for this lesson are on pages 315-318.

Objectives

The child learns how to solve problems that involve division in which the divisor is a number that represents money. He learns about the point in such situations.

Vocabulary

There are no new words.

Comments

There are two types of divisive situations which the child has already studied. In one type he must find the *number* of equal groups when the size of the equal groups and the total number are known (see pages 182 to 191 for examples having two figures in the answer), and in the other type he must find the *size* of the equal groups when the number of groups and the total number are known (see pages 120 to 123). Although the equations used to express these two types of problem situations differ, each one is solved by the same computational method.

In working problems involving division with money, the child will again encounter these two types of problem situations. In each case he will work with two numbers to find another number (the answer). When the answer represents the number of groups, the known numbers he works with will always represent dollars, dollars and cents, or cents only [see the example on page 195]. But when the answer represents the size of the group, *only one* of the numbers the child has to work with represents dollars, dollars and cents, or cents, since the other known number must represent the number of groups [see the example on page 196]. As noted above, the computational method used to find the answer is the same in both types of problem situations.

Notice that the child is asked to do the computation without the interference of the point. (This is actually the only way he *can* operate with the numbers.) If the child has a thorough understanding of the problem situation he started with, he will interpret his answer in the only sensible way it can be interpreted when he has finished his computation.

In your teaching, it is important to pay special attention to thorough understanding of the problem situation. Before the child begins to compute, he must understand very clearly what it is he is going to find out—how many equal groups (for example, how many persons will receive the equal groups of things or how many things can be bought) or how many in a group (for example, how many things each person will get, or how much each thing will cost). If he understands the problem situation, knows that division is the process to use to find the answer, and knows how to do the division, his interpretation of the answer itself should be correct. In the type of problem situation presented in this book in which the answer will be an amount of money, he will know, also, that if there are no more than two figures in the answer, this answer will be read as cents, but that if there are more than two figures, the answer may be expressed as dollars and cents.

In the "How many apples did she buy?" type of problem, there may be a remainder. It will be necessary to stress the meaning of this remainder in problems involving money so that the children understand that the remainder is money and not apples. When discussing the computation for the problem on page 196, let the children discover that the numeral 6 (the divisor) is the same as the number of pennies that will be put down each time a share is taken from the total supply. The computation is the same here as for the problem on page 195; in this case, however, when the child gets the answer, the answer means cents or pennies because it tells how many pennies are in each pile. The 4 (the remainder) still means 4 cents are left over.

Answers

A $\$1.00 \div [\$.33] = 3$ and 1¢ rm.
B $\$1.05 \div [\$.15] = 7$
C $\$1.00 \div \$.08 = [12]$ and 4¢ rm.
D $\$.60 \div \$.05 = [12]$
E $\$2.25 \div [\$.45] = 5$
F $\$.44 \div \$.03 = [14]$ and 2¢ rm.
G $\$.66 \div \$.02 = [33]$
H $\$.66 \div [\$.22] = 3$
I $\$1.20 \div \$.09 = [13]$ and 3¢ rm.
J $\$1.40 \div [\$.35] = 4$
K $\$3.00 \div [\$.75] = 4$

see

A Nancy has $1.60 to buy apples for a party. How many apples at $.06 each can she buy? How much money will she have left over? 1

$1.60 ÷ $.06 = ▢ 2

(Number of apples she can buy; You must find this number.)

compute

B Think of the money in pennies. 3

160 ← Think of $1.60 as 160.

Find how many groups of 6 pennies there are in 160 pennies.

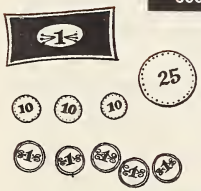
C 4

$$\begin{array}{r|l} 6\overline{)160} & 20 \\ 120 & \\ \hline 40 & 6 \\ 36 & \\ \hline 4 & 26 \end{array}$$ 5

Nancy can buy 26 apples.

She will have 4¢, or $.04, left over.

see



A Six boys collected some old magazines and sold them for $1.60. Then they shared the money equally. Each boy's share was how much? How much money was left over? 1

$1.60 ÷ ▢ = 6

(Number of boys; You must find this amount of money.)

compute

2

B Think of the money in pennies.

160 ← Think of $1.60 as 160.

Each time the boys take 1 penny apiece, a group of 6 pennies will be used.

C 3

$$\begin{array}{r|l} 6\overline{)160} & 20 \\ 120 & \\ \hline 40 & 6 \\ 36 & \\ \hline 4 & 26 \end{array}$$ 4

Each boy's share was 26¢, or $.26.

The boys would have 4¢ left over.

5 D

195

1. Have the children read the problem and relate it to the picture.
2. Have the class relate each number in this equation to the problem and picture.
3. Tell the class to think of the money in pennies so that they will not have to use the point when they compute.
4. Let the class discover that these pennies must be put into groups of 6. Ask, "How many groups of 6 can we have?"
5. Tell the class that if they did not have the money to put into piles, they would work with the numbers, and they would divide by 6 because the objects are to be put into groups of 6. Tell pupils that they must find out how many of these groups or piles there will be. Call special attention to the remainder, and to the fact that this remainder is not apples. (The 26 tells the number of apples, while 4, the remainder, stands for the pennies that are left over.)

196

1. Have the children read the problem and relate it to the equation and picture. Note that this problem uses the same numbers as the previous problem, but now the 6 tells how many equal groups there are, not how many there are in each group.
2. Draw attention to the fact that again the money is to be thought of in pennies, and that there are 160 pennies in $1.60.
3. Explain that the pennies are to be put into 6 equal piles (1 pile for each boy), and point out that 6 pennies have been put down as the beginning of each pile. Tell the class that each time another penny is put in each of the 6 piles, a group of 6 pennies will be taken away from the total supply.
4. Discuss the computation in the manner suggested under "Comments."
5. Draw attention to this picture and let the class see that it shows what the 26 and the 4 in the computation stand for.

A Three boys have $1 to share equally. What is the largest amount of money that each boy can have? Will any money be left over? If so, how much?

THINK When you divide, the answer will be the amount of money each boy can have. The remainder will be the money left over.

$1.00 ÷ ■ = 3 Divide 100 by 3.

B One week Sue earned $1.05 by helping her mother wash dishes and cook. She earned the same amount each day. How much did she earn each day?

$1.05 ÷ ■ = 7 Divide 105 by 7.

C Tony wants to buy some tablets of colored paper. The tablets cost $.08 apiece. How many tablets can he buy with $1? Will he have any money left? If so, how much?

THINK When you divide, the answer will be the number of tablets, and the remainder will be the amount of money left.

$1.00 ÷ $.08 = ■ Divide 100 by 8.

D How many 5-cent notebooks can Tony buy with $.60?

E Five boys are buying a book that costs $2.25. They are sharing the cost equally. How much should each boy pay?

F Jane wants to buy some picture postcards. She has $.44 to spend. The cards cost $.03 each. How many of these cards can she buy? Will she have any money left over? If so, how much?

G Jim and 2 friends collected old bottles and took them to the store. When Jim's mother asked how many bottles the boys had collected, Jim said, "The clerk gave us 2¢ apiece for our bottles, or 66¢ in all." They had collected how many bottles?

H The 3 boys shared the 66¢ equally. How much money did each boy get?

I Carol is buying some combs to put in Junior Red Cross boxes at school. She can get the combs for $.09 each. She has $1.20 to spend. How many combs can she buy? Will she have any money left over? If so, how much?

J Four girls earned $1.40 by taking some smaller children to a wading pool. They shared the money equally. How much was each girl's share?

K Mary has $3 to spend for 4 presents. She wants to spend the same amount for each present. How much can she spend for each present?

Now you should be able to divide amounts of money. 5

197

197

1 Let the children tell what would happen each time the 3 boys take a penny. Have them tell why 100 is divided by 3. Discuss what the answer and the remainder represent.

2 Have the class discuss and explain this problem in the same way they did for Problem A.

3 Tell the children to find out how many equal groups there are; let them go through a demonstration and discussion to show what happens. (Quantities in these problems have been kept small so that, if you want to, you can use money and show the answer.)

4 Let the class work independently on Problems D to K, writing the proper equation with the square or screen, doing the computation, and finally rewriting the equation with the answer.

5 Discuss any problems that caused trouble, referring to the work on pages 195 and 196 if necessary.

198 Keeping skillful

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns the principles of checking.

Vocabulary

There are no new words.

Comments

The authors believe that the best kind of checking the child can do is to work carefully as he goes, checking each major step of his computation before he goes on to the next one. Most careful workers in mathematics check as they go. In a long process it is better not to complete the entire computational procedure without checking, only to find that an error has been made in the early part of the work.

The work on this page includes some of the methods of checking that traditionally have appeared in arithmetic textbooks. The real value of this work lies in its presentation of the relation between multiplication and division, as shown in the work in the first column, and the relation between addition and subtraction, as shown in the work in blue in the second column. These relations are, of course, important for the children to understand. It should be pointed out that, since the work in checking is generally as involved and as subject to error as is the original computation, the child should realize that very careful work in the original computation is a much better method of "checking" than any of the techniques shown on this page.

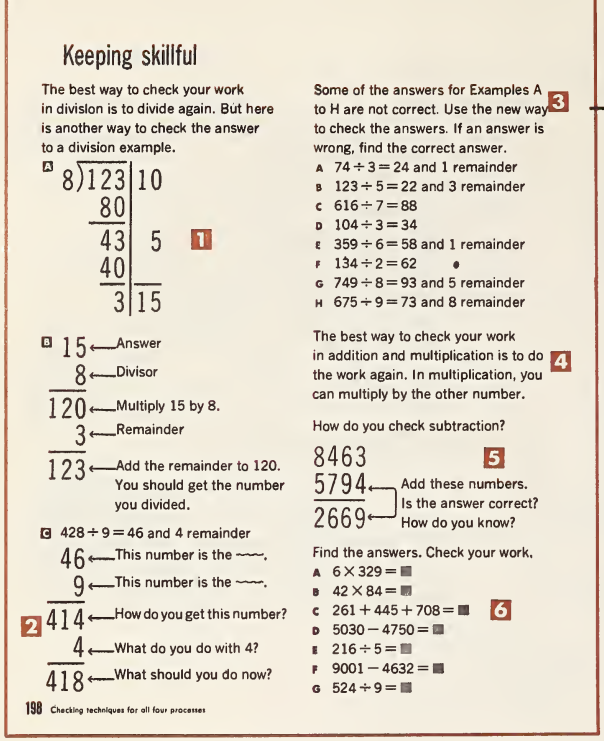
Answers

(block 1)

A Wrong; 24 and 2 rm.
B Wrong; 24 and 3 rm.
C Correct
D Wrong; 34 and 2 rm.
E Wrong; 59 and 5 rm.
F Wrong; 67
G Correct
H Wrong; 75

(block 2)

A 1974
B 3528
C 1414
D 280
E 43 and 1 rm.
F 4369
G 58 and 2 rm.



Keeping skillful

The best way to check your work in division is to divide again. But here is another way to check the answer to a division example.

A
$$\begin{array}{r|l} 8\overline{)123} & 10 \\ 80 & \\ \hline 43 & 5 \\ 40 & \\ \hline 3 & 15 \end{array}$$

1

B
15 ← Answer
8 ← Divisor
120 ← Multiply 15 by 8.
3 ← Remainder
123 ← Add the remainder to 120. You should get the number you divided.

C 428 ÷ 9 = 46 and 4 remainder
46 ← This number is the ~~~.
9 ← This number is the ~~~.
2 414 ← How do you get this number?
4 ← What do you do with 4?
418 ← What should you do now?

Some of the answers for Examples A to H are not correct. Use the new way to check the answers. If an answer is wrong, find the correct answer. 3

A 74 ÷ 3 = 24 and 1 remainder
B 123 ÷ 5 = 22 and 3 remainder
C 616 ÷ 7 = 88
D 104 ÷ 3 = 34
E 359 ÷ 6 = 58 and 1 remainder
F 134 ÷ 2 = 62
G 749 ÷ 8 = 93 and 5 remainder
H 675 ÷ 9 = 73 and 8 remainder

The best way to check your work in addition and multiplication is to do the work again. In multiplication, you can multiply by the other number. 4

How do you check subtraction? 5

8463
5794 ← Add these numbers.
2669 ← Is the answer correct? How do you know?

Find the answers. Check your work. 6

A 6 × 329 = ■
B 42 × 84 = ■
C 261 + 445 + 708 = ■
D 5030 − 4750 = ■
E 216 ÷ 5 = ■
F 9001 − 4632 = ■
G 524 ÷ 9 = ■

198 Checking techniques for all four processes

198

1 Have the pupils relate the work in this example to the work in Example B. Point out that they are finding out if 15 and 3 remainder is the correct answer for the division example. Since 15 is supposed to be the number of equal groups of 8 that 123 can be divided into (with a remainder of 3), if 15 groups of 8 are put together (multiplied), and then 3 is added, the result should be the original group. Since the answer, 123, agrees with the original number, the division answer is correct.

2 Discuss this example in terms of the division that must have been done previously.

3 Have the children read the directions and work on these exercises independently.

4 Discuss this paragraph with the children.

5 Point out to pupils that we can add to check subtraction because if something is taken away from a group, the original group can be found by adding the amount that was taken away.

6 Assign these exercises as written work.

199 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving problems of the types taught thus far in the book.

Vocabulary

New words page 199 neighborhood, club

Comments

As with other problem sets of this type, let the children work independently on these problems before they are discussed. When the children have finished the problems and their answers and equations have been verified, the children can help one another with those problems that only a few of them missed. General discussion of the problems that may have caused difficulties should be guided by consideration of whether the difficulties were in computation or in making the equations. If the pupils had difficulty in making the proper equations, it may be helpful for you to dramatize some of the problems (without paying attention to the number of objects specified in the problems), simply to help the children understand what happened in the problems.

Answers

In addition problems involving imagined action, any order of addends given in the children's equations should be accepted.

A 29 − 15 = [14]
B 42 − 16 = [26]
C 26 − 16 = [10]
D 104 ÷ 8 = [13]
E 664 × $.25 = [$166.00]
F $166 + [$34] = $200
G 32 ÷ 8 = [4]
H 8 + 32 = [40] or 32 + 8 = [40]
I 40 × $.15 = [$6.00]
J $16.00 − $7.50 = [$8.50]
K $2.25 ÷ [$.75] = 3
L [$5.50] + $12.60 = $18.10
M [154] − 130 = 24
N 29 − [21] = 8

Using arithmetic 1

A Twenty-nine children helped with a neighborhood art fair. Fifteen of them were boys. How many girls helped with the art fair?

B David and Mary made 42 name cards, one for each person who sold things at the fair. David made 16 cards, and Mary made the rest. How many name cards did Mary make?

C Mary made how many more name cards than David?

D The art fair was on the school playground. Some of the people who had pictures to sell put their pictures on the fence. Each person could use 8 feet of fence. The fence was 104 feet long. How many people could put their pictures on the fence?

E Each person who came to the fair gave 25¢ for the neighborhood club. 664 people came to the fair. How much in all did they give for the club?

F The neighborhood club needed $200 for its work. After the art fair, the neighborhood club still needed how much money?

G Ann sold balloons at the art fair. She sold 8 white balloons and 32 red ones. She sold how many times as many red balloons as white ones?

H How many balloons in all did Ann sell?

I The balloons sold for 15¢ each. How much money should Ann have collected for the balloons she sold?

J Mary's father bought two pictures at the fair. He paid $7.50 for one and $16 for the other. How much less did he pay for the first picture than for the second picture?

K The three Brown children bought a plate for their mother and shared the cost equally. The plate cost $2.25. How much was each child's share?

L Ellen had a lemonade stand. When she started, she had some money for making change. She sold $12.60 worth of lemonade. When she counted her money at the end of the day, she had $18.10 in all. How much money did she have for making change?

M Ellen said that she used 130 paper cups for the lemonade and still had 24 paper cups left. How many cups did she have to begin with?

N At the end of the day, 8 of the 29 children who helped with the fair were still there. The rest had gone home. How many children had gone home? 2

199

199

1 Let the children work independently on the problems on this page. They should write the equation for each problem, then do the computation, and, finally, rewrite the equation with the answer inserted in the proper place.

2 Supply the children with equations and answers for the problems and have them verify their work. Discuss any problems that the children found difficult.

200-205 Learning how

Expanded Notes for this lesson are on pages 318-319.

Objectives

The child learns to divide when there are two figures in the divisor and two figures in the answer.

Vocabulary

There are no new words.

Comments

The work included in this lesson, usually reserved for Grade 5, is placed here as optional work. It is offered because the authors believe that there is an advantage in having children study division with two-figure divisors immediately after working with one-figure divisors. In this way children can quickly see that there is nothing really different—or difficult—about working with two-figure divisors, for the procedure is the same as with one-figure divisors. If children can divide by one-figure divisors, they should be able to divide by two-figure divisors without any difficulty. With groups of children of below average ability, this material may be omitted in Grade 4.

The problems in this lesson are confined to the type in which the size of the group is known and the number of groups is to be found. A problem involving an answer and a remainder introduces the lesson so that children can see the whole division picture immediately.

In the pictures illustrating the examples no attempt has been made to show all the necessary objects individually, since showing the type of activity rather than the actual number of objects is the purpose of the pictorializations. The objects are shown in bags, boxes, etc.

The four-step teaching method is again used, with those portions of pictures not under discussion dimmed off, and the numerals under discussion in black.

In the TRY step on pages 203 and 204, four ways of doing the work are shown for each example. The fourth way (in color) shows the most efficient solution. Of course, you will allow the child considerable freedom in determining how he is to divide.

At this point, no attempt is made to teach the refinements of getting the best partial quotients. The children are simply taught how to divide; the method of making best estimates for the partial quotients will be considered later.

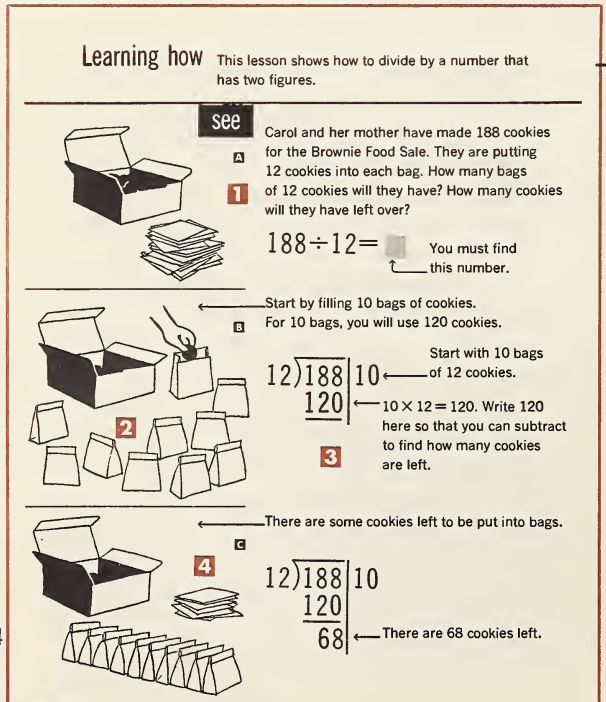
Answers

Learning how:

(block 1)		(block 2)		(block 3)	
A	14	J	26 and 18 rm.	A	49 and 42 rm.
B	7	K	3 and 39 rm.	B	4
C	13 and 11 rm.	L	67 and 43 rm.	C	7 and 5 rm.
D	19 and 27 rm.	M	26	D	33 and 14 rm.
E	15 and 10 rm.	N	90 and 9 rm.	E	40
F	70 and 5 rm.	O	7	F	26 and 42 rm.
G	8 and 11 rm.	P	10 and 60 rm.	G	4 and 17 rm.
H	15 and 4 rm.	Q	52 and 3 rm.	H	86 and 21 rm.
I	18 and 46 rm.	R	50 and 50 rm.		

Keeping skillful:

(block 1)		(block 2)		(block 3)	
A	240 min.	A	152	A	1245
B	10 gal.	B	1230	B	5904
C	48 qt.	C	259	C	348
D	100 qt.	D	674	D	2763
E	180 in.	E	786	E	4248
F	480 sec.	F	687	F	752
G	36 mo.	G	3570	G	17,710
H	11 wk.	H	254	H	4620
I	120 pt.	I	1256	I	912
J	24 yd.	J	286	J	4214
K	147 da.	K	1287	K	1395
L	150 ft.	L	959	L	9810
M	16 gal.	M	4669	M	1848
N	400 oz.	N	1349	N	2944
O	468 in.	O	951	O	10,850


Learning how
This lesson shows how to divide by a number that has two figures.
See
A
1
Carol and her mother have made 188 cookies for the Brownie Food Sale. They are putting 12 cookies into each bag. How many bags of 12 cookies will they have? How many cookies will they have left over?
188÷12=
You must find this number.
B
Start by filling 10 bags of cookies. For 10 bags, you will use 120 cookies.
2
12)188 10
120
Start with 10 bags of 12 cookies.
10×12=120. Write 120 here so that you can subtract to find how many cookies are left.
3
There are some cookies left to be put into bags.
C
4
12)188 10
120
68
There are 68 cookies left.
200 Division by 2-figure divisor, 2-figure quotients (optional work)

200

1 Have pupils read the problem and equation without trying to answer the questions or finding the missing number. They should interpret the picture as showing a box of 188 cookies and an undetermined number of bags into each one of which they will put 12 cookies.

2 The pupils should observe that 10 bags are being used to see if they will hold all the 188 cookies in groups of 12. Ask a pupil how many 10 twelves are.

3 Call attention to where the 10 and the product of 10×12 are put in this computation. Ask someone if all the 188 cookies were used. Ask him what has to be done to find out how many cookies were left.

4 Point out that Picture C shows that filling 10 bags with 12 cookies each did not use up all the cookies. Pupils should see that the computation, after the subtraction has been done, shows that 68 cookies were left.

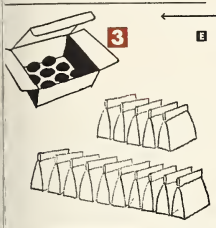
D Next try 5 bags of cookies. For 5 bags you will use 60 cookies.

$$\begin{array}{r|l} 12\overline{)188} & 10 \\ 120 & \\ \hline 68 & 5 \\ 60 & \\ \hline 8 & \end{array}$$

1 2

5 ← Try 5 more bags.

60 ← 5 × 12 = 60. Write 60 here so that you can subtract.



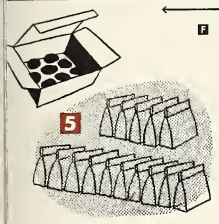
3

E There are only 8 cookies left. 8 cookies are not enough for another full bag.

$$\begin{array}{r|l} 12\overline{)188} & 10 \\ 120 & \\ \hline 68 & 5 \\ 60 & \\ \hline 8 & \end{array}$$

4

8 ← There is a remainder of 8.



5

F There are 15 full bags and 8 cookies left.

$$\begin{array}{r|l} 12\overline{)188} & 10 \\ 120 & \\ \hline 68 & 5 \\ 60 & \\ \hline 8 & 15 \end{array}$$

Add 10 and 5. 6

There are 15 full bags of cookies.

8 cookies are left over.

188 ÷ 12 = 15 and 8 remainder

201

1 Help pupils see that 5 more bags are being used to see if they will hold the remaining 68 cookies.

2 Pupils should note where the 5 and the product of 5 twelves are written.

3 This picture shows that not all the cookies were used. There are 8 cookies left—not enough to fill another bag with 12 cookies.

4 Explain to pupils that after the 5 groups of 12 cookies, or 60 cookies, were subtracted from the 68 cookies, 8 remained.

5 Pupils should understand that to find how many bags in all were needed for the cookies, they must combine the two groups of bags. The dotted background should suggest this combining to them. They can count the total number of bags and see the remainder of 8 cookies.

6 Relate the adding of 10 and 5 (which represent the groups of twelves) to the combining of the two groups of bags in Picture F.

think The Brownies are filling boxes with candy. They have 564 pieces of candy. If they put 25 pieces in each box, how many boxes can they fill? Will any candy be left over? 1

564 ÷ 25 =

↑ You must find this number.

A Start by filling 10 boxes. For 10 boxes you will use 10 × ■, or ■ pieces of candy.

$$\begin{array}{r|l} 25\overline{)564} & 10 \\ 250 & \\ \hline & \end{array}$$

First try ■ twenty-fives.

10 × ■ = 250. Why do you write 250 here?

2

B How many pieces of candy are left to be put in boxes of 25?

$$\begin{array}{r|l} 25\overline{)564} & 10 \\ 250 & \\ \hline 314 & \end{array}$$

3

How do you get 314? What does the 314 show?

C How do you know that you can fill 10 more boxes? You will use ■ × 25, or ■ more pieces of candy.

$$\begin{array}{r|l} 25\overline{)564} & 10 \\ 250 & \\ \hline 314 & 10 \\ 250 & \\ \hline & \end{array}$$

4

Now try ■ more twenty-fives.

How do you get this 250?

D Are there any more pieces of candy left to be put in boxes?

$$\begin{array}{r|l} 25\overline{)564} & 10 \\ 250 & \\ \hline 314 & 10 \\ 250 & \\ \hline 64 & \end{array}$$

5

How do you get 64? What does it show?

E How do you know that you can fill 2 more boxes? You will use 2 × ■, or ■ more pieces of candy.

$$\begin{array}{r|l} 25\overline{)564} & 10 \\ 250 & \\ \hline 314 & 10 \\ 250 & \\ \hline 64 & 2 \\ 50 & \\ \hline & \end{array}$$

6

Try ■ more twenty-fives.

How do you get 50? What does it show?

202

1 Ask pupils to read the problem and equation, without trying to answer the questions or giving the missing number. Call on a pupil to explain why the equation is correct as given.

2 Let someone tell why 10 boxes is a good choice for a first try at finding how many boxes are needed. [It is easy to multiply by 10.]

3 Have pupils check the subtraction of 250 from 564. Ask how many pieces of candy not put in the boxes are left over.

4 Ask pupils how many pieces of candy 10 boxes of 25 pieces used up. Ask them if they can use this many boxes again, and ask why. Have them note that 10 more boxes are tried again.

5 Pupils should note that 64 pieces remain.

6 Help them see that 2 boxes of 25 pieces of candy (or 50 pieces) comes very close to the 64 pieces of candy still left.

F Are there enough pieces of candy left to make another box of 25?

$$\begin{array}{r|l} 25\overline{)564} & 10 \\ 250 & \\ \hline 314 & 10 \\ 250 & \\ \hline 64 & 2 \\ 50 & \\ \hline 14 & \end{array}$$

There is a remainder of ■.

1

G How many boxes of 25 pieces will there be? How many pieces will be left?

What do you do now?

$$\begin{array}{r|l} 25\overline{)564} & 10 \\ 250 & \\ \hline 314 & 10 \\ 250 & \\ \hline 64 & 2 \\ 50 & \\ \hline 14 & 22 \end{array}$$

2

There will be ■ boxes of candy.

■ pieces will be left.

564 ÷ 25 = ■ and ■ remainder

try

A 2585 ÷ 55 = ■

3

$$\begin{array}{r|l} 55\overline{)2585} & 10 \\ 550 & \\ \hline 2035 & 20 \\ 1100 & \\ \hline 935 & 10 \\ 550 & \\ \hline 385 & 5 \\ 275 & \\ \hline 110 & 2 \\ 110 & \\ \hline & 47 \end{array} \qquad \begin{array}{r|l} 55\overline{)2585} & 20 \\ 1100 & \\ \hline 1485 & 20 \\ 1100 & \\ \hline 385 & 5 \\ 275 & \\ \hline 110 & 2 \\ 110 & \\ \hline & 47 \end{array} \qquad \begin{array}{r|l} 55\overline{)2585} & 30 \\ 1650 & \\ \hline 935 & 10 \\ 550 & \\ \hline 385 & 6 \\ 330 & \\ \hline 55 & 1 \\ 55 & \\ \hline & 47 \end{array} \qquad \begin{array}{r|l} 55\overline{)2585} & 40 \\ 2200 & \\ \hline 385 & 7 \\ 385 & \\ \hline & 47 \end{array}$$

2585 ÷ 55 = ■

Now turn the page.

203

B 338 ÷ 37 = ■

1

$$\begin{array}{r|l} 37\overline{)338} & 5 \\ 185 & \\ \hline 153 & 4 \\ 148 & \\ \hline 5 & 9 \end{array} \qquad \begin{array}{r|l} 37\overline{)338} & 8 \\ 296 & \\ \hline 42 & 1 \\ 37 & \\ \hline 5 & 9 \end{array} \qquad \begin{array}{r|l} 37\overline{)338} & 6 \\ 222 & \\ \hline 116 & 3 \\ 111 & \\ \hline 5 & 9 \end{array} \qquad \begin{array}{r|l} 37\overline{)338} & 9 \\ 333 & \\ \hline 5 & \end{array}$$

338 ÷ 37 = ■ and ■ remainder

C 2315 ÷ 46 = ■

$$\begin{array}{r|l} 46\overline{)2315} & 10 \\ 460 & \\ \hline 1855 & 20 \\ 920 & \\ \hline 935 & 20 \\ 920 & \\ \hline 15 & 50 \end{array} \qquad \begin{array}{r|l} 46\overline{)2315} & 20 \\ 920 & \\ \hline 1395 & 30 \\ 1380 & \\ \hline 15 & 50 \end{array} \qquad \begin{array}{r|l} 46\overline{)2315} & 40 \\ 1840 & \\ \hline 475 & 10 \\ 460 & \\ \hline 15 & 50 \end{array} \qquad \begin{array}{r|l} 46\overline{)2315} & 50 \\ 2300 & \\ \hline 15 & \end{array}$$

2315 ÷ 46 = ■ and ■ remainder

D 650 ÷ 78 = ■

$$\begin{array}{r|l} 78\overline{)650} & 5 \\ 390 & \\ \hline 260 & 2 \\ 156 & \\ \hline 104 & 1 \\ 78 & \\ \hline 26 & 8 \end{array} \qquad \begin{array}{r|l} 78\overline{)650} & 6 \\ 468 & \\ \hline 182 & 2 \\ 156 & \\ \hline 26 & 8 \end{array} \qquad \begin{array}{r|l} 78\overline{)650} & 4 \\ 312 & \\ \hline 338 & 4 \\ 312 & \\ \hline 26 & 8 \end{array} \qquad \begin{array}{r|l} 78\overline{)650} & 8 \\ 624 & \\ \hline 26 & \end{array}$$

650 ÷ 78 = ■ and ■ remainder

2

203

1 Pupils should see that 14 pieces are not enough pieces to make another box of 25 and that therefore, there is a remainder of 14 pieces after they subtract 50 from 64.

2 Pupils should see that they must add the partial quotients they have found. Then they should be able to explain what each of the numerals in black means.

3 Tell pupils to put the numbers in this equation in the proper computational form and find the answer. Then they should compare their work and solution with those given in the book. Tell them they must have the correct answer before going on to a new example, but that their work may differ from any of the four examples shown.

204

1 Tell pupils to do these in the same way as they did Example A on page 203. Tell them to keep trying to compute in the shortest and easiest way. Let them work independently and direct them to proceed to the work labeled DO as soon as they get the correct answers for these three examples.

2 After the children have found the answers to Examples A to D, discuss all the different ways of computing given in the book. Point out that those shown in blue illustrate the quickest way to find each answer.

do

A Some Brownies worked a total of 420 min. at the food sale. Each girl worked for 30 min. How many girls worked at the sale?
420 ÷ 30 = ■

B Peggy said, "We worked 420 min. in all. I wonder how many hours we worked." How many hours had the girls worked?
420 ÷ 60 = ■

2

1

C 531 ÷ 40 = ■
D 673 ÷ 34 = ■
E 400 ÷ 26 = ■
F 2175 ÷ 31 = ■
G 107 ÷ 12 = ■
H 859 ÷ 57 = ■
I 1360 ÷ 73 = ■
J 928 ÷ 35 = ■

K 243 ÷ 68 = ■
L 3795 ÷ 56 = ■
M 468 ÷ 18 = ■
N 3789 ÷ 42 = ■
O 560 ÷ 80 = ■
P 700 ÷ 64 = ■
Q 887 ÷ 17 = ■
R 4550 ÷ 90 = ■

A 2639 ÷ 53 = ■
B 300 ÷ 75 = ■
C 173 ÷ 24 = ■
D 641 ÷ 19 = ■
E 1440 ÷ 36 = ■
F 1342 ÷ 50 = ■
G 209 ÷ 48 = ■
H 7503 ÷ 87 = ■

Now you should be able to divide by any number that has two figures.

Keeping skillful

4

A 4 hr. = ■ min.
B 80 pt. = ■ gal.
C 96 pt. = ■ qt.
D 25 gal. = ■ qt.
E 5 yd. = ■ in.
F 8 min. = ■ sec.
G 3 yr. = ■ mo.
H 77 da. = ■ wk.
I 15 gal. = ■ pt.
J 72 ft. = ■ yd.
K 21 wk. = ■ da.
L 50 yd. = ■ ft.
M 64 qt. = ■ gal.
N 25 lb. = ■ oz.
O 13 yd. = ■ in.

4

A 82 + 14 + 56 = ■
B 738 + 492 = ■
C ■ + 641 = 900
D ■ − 375 = 299
E 217 + 205 + 364 = ■
F 2565 − ■ = 1878
G 5330 + ■ = 8900
H 98 + 71 + 85 = ■
I 5002 − 3746 = ■
J ■ + 318 = 604
K 320 + 500 + 467 = ■
L ■ − 431 = 528
M 7349 − 2680 = ■
N ■ − 848 = 501
O 1073 + ■ = 2024

4

A 249 × 5 = ■
B 72 × 82 = ■
C 6 × 58 = ■
D 9 × 307 = ■
E 36 × 118 = ■
F 8 × 94 = ■
G 253 × 70 = ■
H 55 × 84 = ■
I 19 × 48 = ■
J 602 × 7 = ■
K 31 × 45 = ■
L 90 × 109 = ■
M 66 × 28 = ■
N 4 × 736 = ■
O 217 × 50 = ■

205

205

1 .Assign Problems A and B and Exercises C to R as written work. When pupils have finished them, discuss the answers and possible ways of getting them. Let children put examples of possible ways of solving the equations on the board.

2 These exercises should be given to those who seem to need extra practice.

3 Let the children do these orally. Then direct them to write the answers.

4 Assign these exercises as written work. Supply answers so that each child can verify his work.

206-207 Using arithmetic

Exponded Notes are not considered necessory for this lesson.

Objectives

The child practices solving problems of all the types taught in this book.

Vocabulary

There are no new words.

Comments

In this set of problems, the children meet problem situations of all the different types that they have studied in this book. In addition to this, they also practice multiplication of two-figure and three-figure numbers. Also included are problems involving division of two-figure and three-figure numbers.

As usual, the children should work independently on these problems before there is any discussion of them. You will notice that problems that use either information or answers from previous problems are included. The pupils are expected to work these problems without the help of any suggestions such as those labeled "Think" that were given earlier in the book.

Answers

A 2×7=[14]
B 32−19=[13]
C 4×125=[500]
D 35−11=[24]
E 18÷9=[2]
F 18+25=[43]
G 24÷[6]=4
H 11+[13]=24
I [7]+13=20
J 20−9=[11]
K 39−17=[22]
L 22−[16]=6
M 144÷6=[24]
N 24×$.05=[$1.20]
O $1.20÷[$.30]=4
P [26]−7=19
Q 6÷2=[3]
R 6×12=[72]
S 72÷[18]=4
T 365×3=[1095]
U 240÷[80]=3
V 7×120=[840]
W $6.00÷[$1.50]=4

Using arithmetic 1

A Jim, Carol, Sue, and Don spent 2 weeks on Mr. Block's farm in the summer. How many days did they spend on the farm?

B On the way to the farm, Jim counted 32 trucks, and Don counted 19 trucks. Don counted how many fewer trucks than Jim?

C At the farm Mr. Block showed some little chickens to the children. Mr. Block said that he had about 125 of them in each of 4 chicken houses. He had about how many little chickens?

D Mr. Block also showed the children his cows and sheep. He had 35 cows and 11 sheep. He had how many more cows than sheep?

E On the farm there was a pond about 18 yards long and about 9 yards wide. This pond was about how many times as long as it was wide?

F Mr. Block sold 18 pt. of honey one day and 25 pt. the next. He sold how many pints of honey on those 2 days?

G One day the children helped pick blueberries. They picked 24 boxes. Each of the 4 children picked the same number of boxes. How many boxes did each child pick?

H The children picked 11 boxes of blueberries in the morning and the others in the afternoon. How many boxes of blueberries did they pick in the afternoon? 2

I One morning Jim and Don caught some minnows in the pond. They caught 13 more in the afternoon. Then they had 20 minnows. How many minnows had Jim and Don caught in the morning?

J Jim caught 9 of the minnows, and Don caught the others. How many of the 20 minnows did Don catch?

K On Saturday morning Mr. Block had 39 baskets of peaches and sold 17 of them. How many baskets of peaches did he have then?

L Saturday afternoon Mr. Block sold some more peaches. Then he had only 6 baskets left. How many baskets did he sell Saturday afternoon? 2

M The children picked 144 peaches and put them into bags. They put 6 peaches into each bag. How many bags did they fill with peaches?

N Mr. Block paid the children $.05 for each bag of peaches they picked and filled. How much money did he give them for all the bags of peaches? 2

O The 4 children divided this money equally. Each child's share amounted to how much money? 1

P Another day the children picked some peaches in the morning. They ate 7 of them for lunch. Then 19 peaches were left. How many peaches had the children picked that morning?

Q Mrs. Block made butter one day. She said that she used 6 pints of cream. This amount of cream was equal to how many quarts?

R Sue helped Mrs. Block make 6 doz. cookies. How many cookies was this?

S The cookies filled 4 cooky sheets. Mrs. Block put the same number of cookies on each sheet. How many cookies did she put on each sheet? 1

T Mr. Block said that he spent 3 hr. each day milking his cows. How many hours would he spend in this way in a year?

U Mr. Block sold 240 gallons of milk in 3 days. He said that he had sold the same amount of milk each day. How many gallons of milk had he sold each day?

V Mr. Block said that his cows gave about 120 gallons of milk each day. About how many gallons of milk did his cows give in one week?

W By the time the children went home, they had earned $6.00 in all by helping on the farm. Each child had earned the same amount. How much money had each child earned? 2

Checking up

	Test 1	Test 2	Test 3	Test 4
A	81 ÷ 3 = ▩	645 ÷ 8 = ▩	420 ÷ 5 = ▩	629 ÷ 25 = ▩
B	97 ÷ 8 = ▩	212 ÷ 3 = ▩	631 ÷ 7 = ▩	823 ÷ 32 = ▩
C	83 ÷ 4 = ▩	481 ÷ 5 = ▩	84 ÷ 6 = ▩	160 ÷ 37 = ▩
D	60 ÷ 5 = ▩	468 ÷ 7 = ▩	480 ÷ 8 = ▩	720 ÷ 12 = ▩
E	96 ÷ 7 = ▩	270 ÷ 3 = ▩	65 ÷ 3 = ▩	1587 ÷ 46 = ▩
F	76 ÷ 2 = ▩	582 ÷ 6 = ▩	261 ÷ 9 = ▩	6873 ÷ 74 = ▩
G	89 ÷ 6 = ▩	315 ÷ 4 = ▩	55 ÷ 5 = ▩	3101 ÷ 89 = ▩
H	91 ÷ 9 = ▩	828 ÷ 9 = ▩	72 ÷ 3 = ▩	304 ÷ 58 = ▩
I	43 ÷ 3 = ▩	716 ÷ 8 = ▩	650 ÷ 9 = ▩	765 ÷ 18 = ▩
J	64 ÷ 5 = ▩	284 ÷ 7 = ▩	318 ÷ 4 = ▩	3871 ÷ 56 = ▩

End-of-block tests on division (1-figure and 2-figure divisors) (Test 4 optional)

206

1 Have the children work independently on Problems A to W (Problems O to W are on page 207).

2 Note that this problem uses data from preceding problems. The children should be expected to observe this without any suggestions from you or the book.

207

1 Note that this problem uses data from preceding problems. The children should observe this without any suggestions from you.

2 When the pupils have finished working, supply them with equations and answers, and let them verify their work. In discussing problems that the children found difficult, determine whether the difficulty resulted from making an incorrect equation or from inability to do the computation properly. Any necessary reteaching will, of course, depend upon which of these was the source of difficulty.

207 Checking up

Expanded Notes are not considered necessary for this lesson.

Objectives

The child tests his knowledge of division of two-figure, three-figure, and four-figure numbers by one-figure and two-figure divisors.

Vocabulary

There are no new words.

Comments

These tests should be used for diagnosis of difficulties, and sufficient time should be allowed so that most children finish the tests easily. Some of the exercises in each test involve division with remainders. Test 4 also provides a good check on the ability of those children who have learned to compute with two-figure divisors.

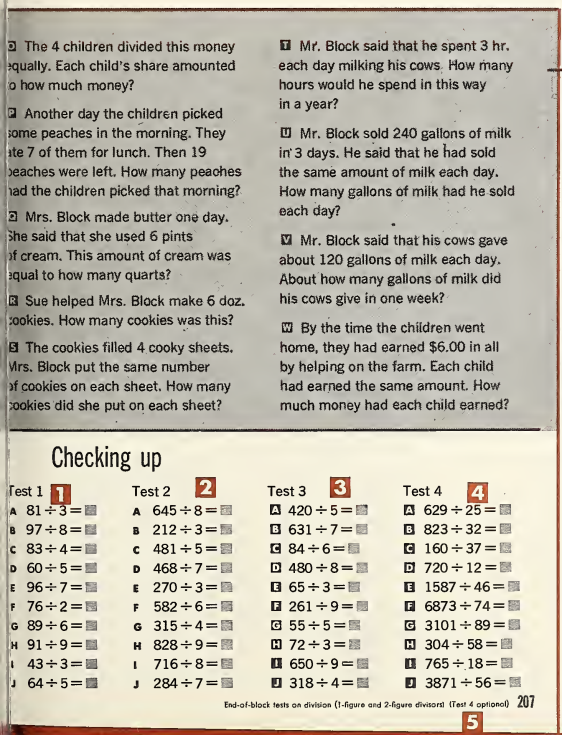
If the children have any significant amount of difficulty, reteaching is, of course, necessary. In reteaching for Tests 1, 2, and 3, use pages 182 to 191 of the pupils' book. Test 4 should be given only if the work on pages 200 to 205 has been taught. Use these pages for reteaching if the children have difficulty with Test 4.

Answers

Test 1	Test 2	Test 3
A 27	A 80 and 5 rm.	A 84
B 12 and 1 rm.	B 70 and 2 rm.	B 90 and 1 rm.
C 20 and 3 rm.	C 96 and 1 rm.	C 14
D 12	D 66 and 6 rm.	D 60
E 13 and 5 rm.	E 90	E 21 and 2 rm.
F 38	F 97	F 29
G 14 and 5 rm.	G 78 and 3 rm.	G 11
H 10 and 1 rm.	H 92	H 24
I 14 and 1 rm.	I 89 and 4 rm.	I 72 and 2 rm.
J 12 and 4 rm.	J 40 and 4 rm.	J 79 and 2 rm.

Test 4

A 25 and 4 rm.	E 34 and 23 rm.	H 5 and 14 rm.
B 25 and 23 rm.	F 92 and 65 rm.	I 42 and 9 rm.
C 4 and 12 rm.	G 34 and 75 rm.	J 69 and 7 rm.
D 60		


A The 4 children divided this money equally. Each child's share amounted to how much money?
B Another day the children picked some peaches in the morning. They ate 7 of them for lunch. Then 19 peaches were left. How many peaches had the children picked that morning?
C Mrs. Block made butter one day. She said that she used 6 pints of cream. This amount of cream was equal to how many quarts?
D Sue helped Mrs. Block make 6 doz. cookies. How many cookies was this?
E The cookies filled 4 cooky sheets. Mrs. Block put the same number of cookies on each sheet. How many cookies did she put on each sheet?
T Mr. Block said that he spent 3 hr. each day milking his cows. How many hours would he spend in this way in a year?
U Mr. Block sold 240 gallons of milk in 3 days. He said that he had sold the same amount of milk each day. How many gallons of milk had he sold each day?
V Mr. Block said that his cows gave about 120 gallons of milk each day. About how many gallons of milk did his cows give in one week?
W By the time the children went home, they had earned $6.00 in all by helping on the farm. Each child had earned the same amount. How much money had each child earned?
Checking up
Test 1 1
A 81 ÷ 3 =
B 97 ÷ 8 =
C 83 ÷ 4 =
D 60 ÷ 5 =
E 96 ÷ 7 =
F 76 ÷ 2 =
G 89 ÷ 6 =
H 91 ÷ 9 =
I 43 ÷ 3 =
J 64 ÷ 5 =
Test 2 2
A 645 ÷ 8 =
B 212 ÷ 3 =
C 481 ÷ 5 =
D 468 ÷ 7 =
E 270 ÷ 3 =
F 582 ÷ 6 =
G 315 ÷ 4 =
H 828 ÷ 9 =
I 716 ÷ 8 =
J 284 ÷ 7 =
Test 3 3
A 420 ÷ 5 =
B 631 ÷ 7 =
C 84 ÷ 6 =
D 480 ÷ 8 =
E 65 ÷ 3 =
F 261 ÷ 9 =
G 55 ÷ 5 =
H 72 ÷ 3 =
I 650 ÷ 9 =
J 318 ÷ 4 =
Test 4 4
A 629 ÷ 25 =
B 823 ÷ 32 =
C 160 ÷ 37 =
D 720 ÷ 12 =
E 1587 ÷ 46 =
F 6873 ÷ 74 =
G 3101 ÷ 89 =
H 304 ÷ 58 =
I 765 ÷ 18 =
J 3871 ÷ 56 =
End-of-block tests on division (1-figure and 2-figure divisors) (Test 4 optional) 207
5

207

1. This is a test on division of two-figure numbers by one-figure numbers.
2. This test is on division of three-figure numbers by one-figure numbers.
3. This is a test on the division of both two-figure and three-figure numbers by one-figure numbers.
4. This is a test on division of three-figure and four-figure numbers by two-figure numbers. The use of this test is optional, depending upon whether or not the lesson on division with two-figure divisors has been taught.
5. After the children have finished these tests, do any reteaching you feel is necessary.

208-211 Looking back

Expanded Notes for this lesson are on pages 320-321.

Objectives

The child learns how to use two numerals (a fraction) to show parts of one thing or parts of a group of things. He learns how to read and write the numerals that stand for fractions through sixteenths.

Vocabulary

New words page 208 fractions, compares, whole*

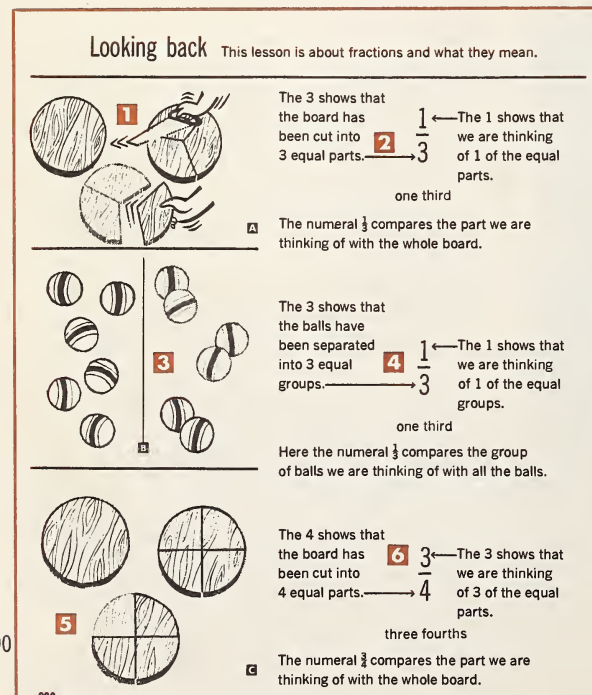
Comments

With this lesson the child learns to use two integers to make a new kind of numeral—a fraction—to represent parts of a thing or parts of a group.

To find two thirds of a whole thing or a group of things, the child learns he must first divide the object or objects into three equal parts or groups (partitive division) and then take two of these parts or groups. He learns to symbolize these events by writing the two numbers with a bar between them ($\frac{2}{3}$). The numeral below the line shows the number of equal parts in the whole. The numeral above the line shows the number being considered.

In this book the unit fraction (a fraction whose numerator is 1) and the non-unit fraction (a fraction whose numerator is more than 1) are developed together as well as the concept that a fraction can be either part of a whole thing or part of a group of things. The advantage of this new approach is that the child begins to get the general concept of fractions from the start. For example, he does not get the idea that fractions having a numerator of more than 1 are very different from fractions having a numerator of 1. Similarly, he is less likely to get the idea that fractions of a group are quite different in meaning from fractions of a single object.

As is usual, the parts of the picture not being discussed are dimmed off in this lesson, leaving the undimmed parts as the focus of attention.


Looking back
This lesson is about fractions and what they mean.
1
The 3 shows that the board has been cut into 3 equal parts.
2
1/3
The 1 shows that we are thinking of 1 of the equal parts.
one third
A
The numeral 1/3 compares the part we are thinking of with the whole board.
3
The 3 shows that the balls have been separated into 3 equal groups.
4
1/3
The 1 shows that we are thinking of 1 of the equal groups.
one third
B
Here the numeral 1/3 compares the group of balls we are thinking of with all the balls.
5
The 4 shows that the board has been cut into 4 equal parts.
6
3/4
The 3 shows that we are thinking of 3 of the equal parts.
three fourths
C
The numeral 3/4 compares the part we are thinking of with the whole board.
208
Reteaching of meaning of fractions. Reading and writing fractions

208

1. Let pupils discover that the circular board was cut into 3 pieces and that one of the 3 pieces is being taken. Explain to them that the hand is removing one third of the board.
2. Direct attention to this text and the large $\frac{1}{3}$. Relate the denominator to the number of equal parts of the board and the numerator to the 1 piece that is being taken.
3. Help pupils see that the balls in the first scene have been separated into 3 equal groups in the second scene. Get them to notice that the group of undimmed balls is 1 of 3 equal groups. Explain we can say these balls are $\frac{1}{3}$ of the entire group.
4. Tell pupils to read and study this text.
5. Children should see that here the circular board has been cut into 4 equal parts and that 3 of the 4 parts are undimmed.
6. Be sure pupils relate the numerator of the fraction to the 3 undimmed pieces of the board. Have pupils read the complete text.

The 4 shows that the blocks have been separated into 4 equal groups. 2

$\frac{3}{4}$ ← The 3 shows that we are thinking of 3 of the equal groups.

three fourths

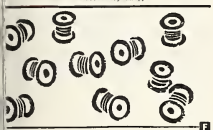
Here the numeral $\frac{3}{4}$ compares the blocks we are thinking of with all the blocks.

The 5 shows that the board has been cut into 5 equal parts. 4

$\frac{2}{5}$ ← The 2 shows that we are thinking of 2 of the equal parts.

two fifths

The numeral $\frac{2}{5}$ compares the part we are thinking of with the whole board.

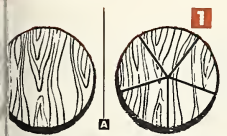


The 5 shows that the spools have been separated into 5 equal groups. 6

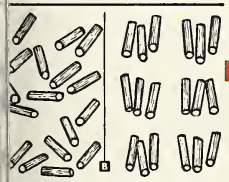
$\frac{2}{5}$ ← The 2 shows that we are thinking of 2 of the equal groups.

two fifths

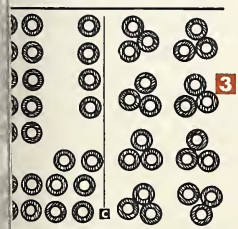
Here the numeral $\frac{2}{5}$ compares the spools we are thinking of with all the spools.



A The board in Picture A is cut into ▪ equal parts.
Each part is one fifth of the board.
Each part is $\frac{1}{5}$ of the board.
4 parts are ▪ fifths of the board.
4 parts are $\frac{\square}{5}$ of the board.

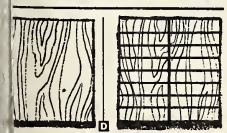


B The 18 sticks in Picture B are separated into ▪ equal groups.
They are separated into sixths.
Each group of 3 sticks is ▪ sixth, or $\frac{1}{6}$.
3 of these groups are ▪ sixths, or $\frac{\square}{6}$.
5 of these groups are ▪ sixths, or $\frac{\square}{6}$.



C The 24 rings in Picture C are separated into ▪ equal groups.
They are separated into eighths.
Each group of 3 rings is ▪ eighth, or $\frac{\square}{8}$.
5 groups of 3 rings are ▪ eighths, or $\frac{\square}{8}$.

D $\frac{7}{8}$ of the rings = ▪ groups of 3 rings



E The board in Picture D is cut into ▪ equal parts.
It is cut into ~~~.
Each part is $\frac{1}{16}$ of the board.

F 3 parts are $\frac{\square}{16}$ of the board.

G 6 parts are $\frac{\square}{16}$ of the board.

H $\frac{11}{16}$ of the board = ▪ parts

I Fractions are shown by numerals like $\frac{1}{2}$, $\frac{1}{5}$, $\frac{3}{4}$, and $\frac{9}{16}$. Whole numbers are shown by numerals like 7, 19, 126, and 2000. Write 5 fractions. Write 5 whole numbers. 5

1 2 3 4

209

1 Get pupils to observe that the blocks in the first scene have been separated into 4 equal groups in the second scene. Let them determine that 3 of the 4 groups are undimmed.

2 Help them relate the 3 in the numerator to the 3 equal groups of undimmed blocks and the 4 in the denominator to the number of groups in all. Then call on a pupil to read the text aloud.

3 Help pupils see that the board has been cut into 5 equal parts and that in the third picture 2 of the 5 parts are undimmed.

4 Adapt Note 2 to this text.

5 Pupils should see that the spools in the first scene have been separated into 5 groups in the second scene and that 2 of the 5 groups are undimmed.

6 Call on someone to explain the meaning of the large $\frac{2}{5}$ before the text is read.

210

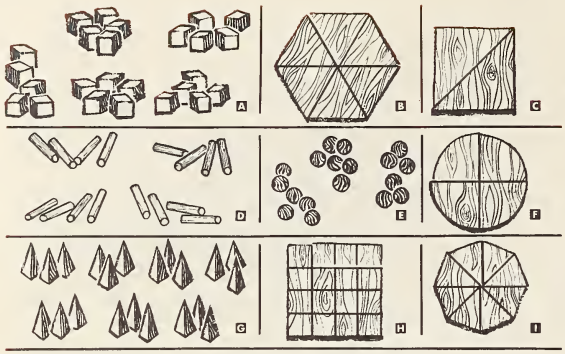
1 Direct attention to the picture and let pupils discover that the board has been cut into 5 equal parts. Then call on various pupils to read and complete the statements in the text. Be sure they understand that the denominator stands for the number of equal parts into which the board has been divided and that the numerator shows how many parts are being considered.

2 Treat this picture and its text in the same way as suggested in Note 1, calling attention to the fact that the sticks have been separated into 6 equal groups.

3 Use Exercises C and D with this picture. Make sure pupils see that the rings have been separated into 8 equal groups.

4 Use Exercises E to H with this picture.

5 Assign this exercise as written work and discuss the answer afterwards.



1 A For each picture write the numeral that tells what fraction of the picture is blue.

2 B For each picture write the numeral that tells what fraction of the picture is not blue.

3 C Which is more, one half dozen balls or one third dozen balls?

4 D Which is less, one fifth of a stick, or one sixth of the same stick?

5 Read.

A	B	C	D	E	F	G	H	I
$\frac{3}{5}$	$\frac{12}{16}$	$\frac{1}{4}$	$\frac{4}{7}$	$\frac{5}{6}$	$\frac{1}{9}$	$\frac{4}{8}$	$\frac{2}{3}$	$\frac{1}{6}$

J	K	L	M	N	O	P	Q	R
$\frac{7}{8}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{5}$	$\frac{3}{4}$	$\frac{2}{5}$	$\frac{9}{10}$	$\frac{5}{8}$	$\frac{7}{12}$

6 Write with numerals.

A two fourths	G five eighths
B one tenth	H four fifths
C one fifth	I three sevenths
D five sixths	J three eighths
E two thirds	K two sixths
F one half	L three fifths

Now you know how to read and write numerals that stand for fractions of one whole thing. The whole thing may be an apple or a pound of sugar, or it may be a group of apples or many pounds of sugar.

211

211

1 Use Pictures A to I with this exercise and have pupils write the answers.

2 Apply Note 1 to this exercise.

3 If pupils have difficulty with Exercise C, draw two sets of one dozen balls each on the board. With the two sets of one dozen balls, get children to determine how many are in one half dozen and how many are in one third dozen balls.

4 For Exercise D, draw two sticks equal in length. Divide one into fifths and the other into sixths. Have the children compare $\frac{1}{5}$ of a stick with $\frac{1}{6}$ of a stick of the same length. Try to get them to see that the larger the denominator, the smaller the equal parts or groups of the same thing.

5 Treat this as an oral exercise.

6 Assign this exercise as written work.

212-215 Moving forward

Expanded Notes for this lesson are on pages 322-323.

Objectives

The child learns that different numerals may represent the same fractions.

Vocabulary

There are no new words.

Comments

The purpose of this lesson is not to teach children how to change fractions to equivalent fractions by computation. Instead, pupils are expected to study fractions that are illustrated by pictures and to get answers to exercises by referring to pictures. Only a few of the last exercises (on page 215) do not have pictures for reference, and by this time children should be able to use a general principle to get the answers. The children should understand that such numerals as $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{4}{8}$, for example, all stand for the same fractional part of a thing or group even though the numbers involved in determining each of these fractional parts of an object or objects differ for each of them.

The illustrations on page 212 suggest the kind of actions that are involved in showing the relations among fractions that are equal. You may want to supplement the work in the book by providing paper and letting the children make the comparisons of fractions by folding the paper as shown in the book or by using objects for the work on page 214.

The first two pages of this lesson show fractional equivalents that are parts of one thing. The last two pages show fractional equivalents that are parts of groups. Note that a pictorial representation for unit fractions through ninths is presented on page 215.

Moving forward

In this lesson you will see that fractions can be written in different ways.

A

1

A round piece of paper is being folded into 2 equal parts.
Each part is what fraction of the paper?
There are ■ halves in one.
$1 = \frac{?}{2}$

B

2

The paper is folded again.
Now it is folded into ■ equal parts.
Each part is what fraction of the paper?
There are ■ fourths in one.
How many fourths are there in each half?
$1 = \frac{4}{4}$ $\frac{1}{2} = \frac{?}{4}$

C

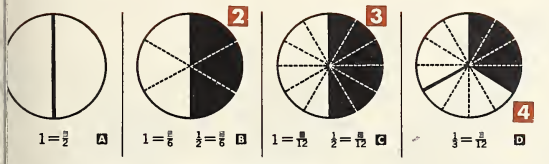
3

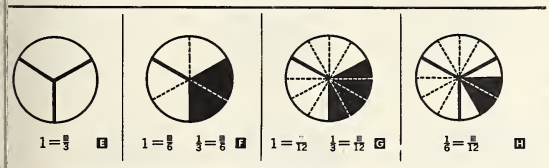
When the paper is folded again, there are ■ equal parts.
How many eighths are there in one?
How many eighths are there in each half?
$1 = \frac{8}{8}$ $\frac{1}{2} = \frac{4}{8}$

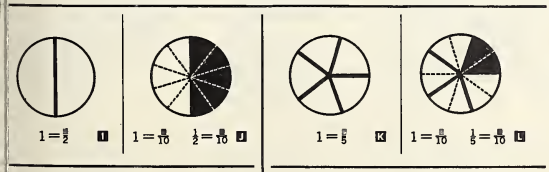
4

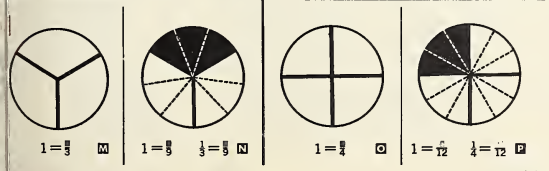
D

The paper is folded once more.
Now there are ■ equal parts.
How many sixteenths are there in one?
How many sixteenths are there in each half?
$1 = \frac{16}{16}$ $\frac{1}{2} = \frac{?}{16}$









212

1 Get the children to observe that a circular piece of paper is being folded into 2 equal parts. Then have them read the text, answer the question, and give the missing number.

2 Have children note that the paper is now being folded into 4 equal parts. They should get the missing number and answer the questions in the text by referring to the picture.

3 Pupils should see that now the paper is being folded into 8 equal sections. The picture should enable the pupils to supply the missing number and answers to the questions in the accompanying text.

4 Pupils should use the picture to see that the paper is being folded into 16 equal parts, and to get answers and missing numbers in the accompanying text. You may want to have the children duplicate the action shown in the pictures by folding pieces of paper themselves.

213

1 Let pupils observe that one whole circle has been divided into two equal parts.

2 Let pupils count the equal parts to find that the circle is now divided into six equal parts. Pupils should see that one half of the circle is colored. By counting the equal parts in this colored half, they should be able to find out that $\frac{1}{2} = \frac{3}{6}$, and to complete the text.

3 Adapt Note 2 to this circle.

4 Pupils should see that the circle is still divided into twelfths. Help them also to see that the colored section is now $\frac{1}{3}$ of the circle. Help them find the outlines of the other thirds. By counting the equal parts in $\frac{1}{3}$ of the circle, they should be able to find how many twelfths $\frac{1}{3}$ equals, and to complete the text.

5 Adapt procedures suggested above to the appropriate circles in these pictures.

A Here are some paper cups.
Think of them as one group. 1

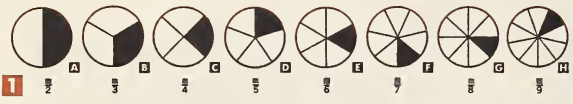
B Now the cups have been separated into 2 equal groups. 2
Each group is $\frac{1}{2}$ of all the cups.
$1 = \frac{2}{2}$

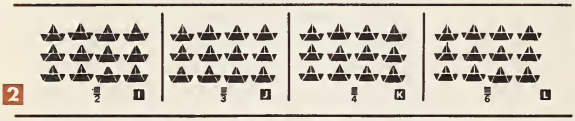
C Each box of cups has been separated again.
Each half has been separated into 2 equal groups. 3
Each new group is $\frac{1}{4}$ of all the cups.
There are how many fourths in each half?
$1 = \frac{4}{4}$ $\frac{1}{2} = \frac{2}{4}$

D Now each of the 4 groups of cups has been separated again.
Each fourth has been separated into 2 equal groups. 4
How many equal groups are there?
Each group is $\frac{1}{8}$ of all the cups.
There are ■ eighths in each half.
There are ■ eighths in each fourth.
$1 = \frac{8}{8}$ $\frac{1}{2} = \frac{4}{8}$ $\frac{1}{4} = \frac{2}{8}$

E Into how many parts has each small group in Picture E been separated now?
Each part is $\frac{1}{16}$ of all the cups.
$1 = \frac{16}{16}$ $\frac{1}{2} = \frac{8}{16}$ $\frac{1}{4} = \frac{4}{16}$ $\frac{1}{8} = \frac{2}{16}$

214





3

A Which is larger, $\frac{1}{2}$ or $\frac{1}{3}$ of a circle?

B Which is fewer, $\frac{1}{8}$ or $\frac{1}{5}$ of a group of pictures?

C Which is smaller, $\frac{1}{3}$ or $\frac{1}{4}$ of a square?

D Which is more, $\frac{1}{6}$ or $\frac{1}{8}$ of a group of paper cups?

E Which is larger, $\frac{1}{4}$ or $\frac{1}{12}$ of a piece of paper?

F Which is more, $\frac{1}{8}$ or $\frac{1}{3}$ of a group of paper boats?

4 Write these fractions so that the smallest fraction is first, the second smallest one is next, the third smallest one is next, and so on.

A $\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{7}$, $\frac{1}{10}$

B $\frac{1}{2}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$

C $\frac{1}{16}$, $\frac{1}{2}$, $\frac{1}{12}$, $\frac{1}{9}$

D $\frac{1}{16}$, $\frac{1}{7}$, $\frac{1}{4}$, $\frac{1}{16}$

E $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{12}$

F $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{10}$, $\frac{1}{16}$

G $\frac{1}{12}$, $\frac{1}{5}$, $\frac{1}{10}$, $\frac{1}{2}$

H $\frac{1}{2}$, $\frac{1}{7}$, $\frac{1}{4}$, $\frac{1}{6}$

I $\frac{1}{3}$, $\frac{1}{16}$, $\frac{1}{5}$, $\frac{1}{8}$

J $\frac{1}{9}$, $\frac{1}{12}$, $\frac{1}{4}$, $\frac{1}{16}$

K $\frac{1}{3}$, $\frac{1}{7}$, $\frac{1}{12}$, $\frac{1}{10}$

L $\frac{1}{15}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{12}$

M $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{10}$, $\frac{1}{3}$

N $\frac{1}{10}$, $\frac{1}{5}$, $\frac{1}{15}$, $\frac{1}{16}$

Now you see that fractions which stand for a part of one thing can be written in different ways.

214

1 Have pupils read this text and relate it to Picture A.

2 Ask pupils to read the first two lines of this text and relate them to Picture B. Pupils should complete the last two lines of the text by referring to Picture B.

3 Focus attention on the 4 equal groups. By referring to Picture C children should see that $\frac{1}{2}$ of the original group is equal to $\frac{2}{4}$. Call on pupils to read and complete the text.

4 Ask pupils to read the first four lines of the text. Pupils should answer the question and get the missing numbers by referring to Picture D.

5 In Picture E pupils should understand that the cups in groups of two in Picture D have now been separated so that there are 16 single cups. The picture should help them supply the numbers called for in the text. The children may use objects to duplicate the action of the picture.

215

1 By determining the number of equal parts each of the circles in Pictures A to H is divided into, and what part the colored section is, pupils should be able to supply the numbers missing from the text.

2 For Pictures I to O first have the children find out how many equal groups there are in each picture. In Picture I, draw attention to the 2 under the line and have the children discover that this suggests they are to think of the hats as separated into 2 equal groups. In Picture J, they should see that the 3 indicates they are to think of the hats as separated into 3 equal groups, and so on for the rest of the pictures. Have them tell what fractional part of all the objects the group of red objects is. They should also tell what fractional part of all the objects are not red.

3 Let pupils use Circles A to H above in answering these questions.

4 Assign these exercises as written work.

216-219 Moving forward

Expanded Notes for this lessan ore on pages 323-324.

Objectives

The child generalizes his ideas about fractions to include improper fractions and mixed numbers.

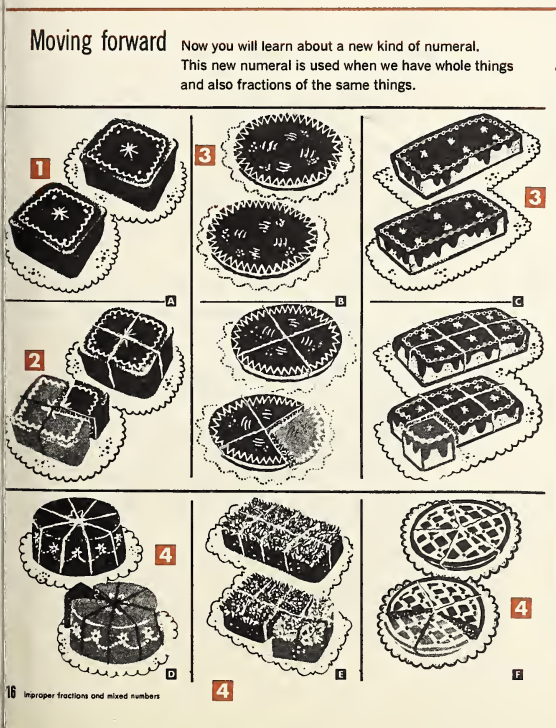
Vocabulary

There are no new words.

Comments

The authors believe that a child gets a clear idea of fractions only when he meets enough of them to make some generalizations and to see them as a system. For this reason improper fractions and mixed numbers are introduced at this time.

Through pictorial representations the child is helped to see that there can be "fractions" in which the numerator is larger than the denominator and mixed numbers in which there are both a whole number (standing for a whole thing or things) and a fractional number (standing for a fraction of the same kind of thing). They learn that an improper fraction and a mixed number may be equal—that they both can stand for the same thing. Fractions with denominators through 16 are included in this treatment. Neither of the terms *improper fraction* nor *mixed number* is used in the text. At your discretion, you may want to introduce the term *mixed number* in your oral discussions.



216

1. Get pupils to see that there are two cakes the same size in the first scene of Movie A.
2. Help them to see that each cake is divided into fourths in the second scene. Ask someone to count the fourths to find that there are 8 fourths in all. Then ask how many of the fourths are heavy blue. If the answer is given as "5," guide the pupil to give the fractional name "five fourths." Tell pupils that there is another way to say the same thing. Ask them if there is one whole cake that is heavy blue. Then ask them how many fourths of the second cake are heavy blue. When the answer "one fourth" is obtained, point out that they can say "one and one fourth" to show how much of the two cakes is heavy blue.
3. Adapt the procedure suggested in Notes 1 and 2 to this movie.
4. Adapt the procedure of Note 2 to this picture. Scene 1 is now omitted.

2

The 4 shows that each cake has been cut into 4 equal parts. → $\frac{5}{4}$ ← The 5 shows that we are thinking of 5 of the equal parts.

five fourths

4

This 1 shows we are thinking of 1 of the two equal cakes. → $1\frac{1}{4}$ ← This 1 shows that we are thinking of 1 of the 4 equal parts of one of the cakes.

The 4 shows that the other cake has been cut into 4 equal parts. →

one and one fourth

The 3 shows that each cake has been cut into 3 equal parts. → $\frac{8}{3}$ ← The 8 shows that we are thinking of 8 of the equal parts.

eight thirds

217

2

This 2 shows we are thinking of 2 of the three equal cakes. → $2\frac{2}{3}$ ← This 2 shows we are thinking of 2 of the 3 equal parts of the third cake.

The 3 shows that the other cake has been cut into 3 equal parts. →

two and two thirds

A In Picture K we are thinking of 1 whole cake and what fraction of the other cake? We are thinking of 1 cake and $\frac{1}{2}$ of the other cake. We are also thinking of $\frac{\square}{2}$ of the cakes. 4

$1\frac{1}{2} = \frac{\square}{2}$ $\quad \frac{3}{2} = 1\frac{\square}{2}$

B In Picture L we are thinking of 3 whole cakes and what fraction of the other cake? We are thinking of 3 whole cakes and $\frac{\square}{4}$ of a cake. We are also thinking of $\frac{15}{\square}$ of the cakes.

$3\frac{3}{4} = \frac{\square}{4}$ $\quad \frac{15}{4} = \square\frac{3}{4}$

C In Picture M we are thinking of 2 cakes and $\frac{3}{\square}$ of another cake. We are also thinking of $\frac{\square}{6}$ of the cakes.

$2\frac{3}{6} = \frac{15}{\square}$ $\quad \frac{15}{6} = 2\frac{\square}{6}$

D In Picture N we are thinking of ■ cake and $\frac{5}{\square}$ of the other cake. We are also thinking of $\frac{13}{\square}$ of the cakes.

$1\frac{5}{8} = \frac{\square}{8}$ $\quad \frac{13}{8} = \square\frac{5}{8}$

218

217

1 Get children to see that there are 2 equal cakes and that each has been divided into fourths. Let them determine that there are 5 fourths in heavy color in the second scene.

2 Tell pupils that here they are finding out how to write what they saw in the picture. Ask someone to read the text aloud.

3 Help pupils see that the 2 cakes are divided into fourths. After they observe that there are 5 fourths in heavy color in Scene 2, ask questions like these: "Do you see 1 whole cake in heavy color? How many fourths of the other cake are in heavy color? How much cake is shown in heavy color?" Be sure the answer is "one and one fourth."

4 Call on pupils to read the explanatory text opposite the mixed number. You might carry this exercise further by asking a pupil to write on the board another way to show what he saw in Movie H [$\frac{5}{4}$].

5 Adapt Notes 1 and 2 to this picture and text.

218

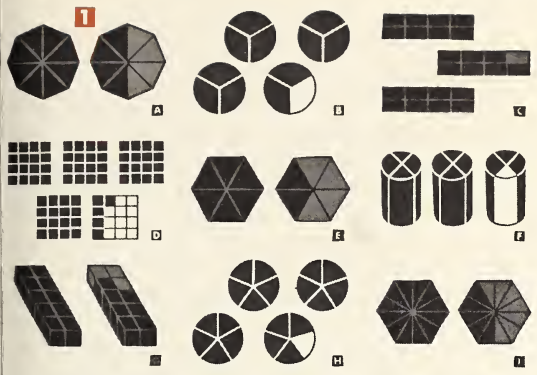
1 Get pupils to see that there are 3 cakes in Scene 1 and that in Scene 2 one of them has been divided into 3 equal parts. Ask them how much cake is in heavy blue in Scene 2.

2 Have pupils explain this mixed number by referring to the picture. Ask someone to read the text.

3 Have pupils notice first that there is 1 cake with its halves together and 1 cake in which the halves are separated. Help them see that $1\frac{1}{2}$ of the cakes are heavy red. Then ask them to think of the first cake in terms of halves. Ask how many halves in all are heavy red.

4 Call on someone to read this text, using Picture K to answer questions. Make sure pupils understand that both $\frac{3}{2}$ and $1\frac{1}{2}$ are ways of expressing the amount of cake shown in Picture K.

5 Proceed in the same way with these pictures and the accompanying text.



For each picture above, write two numerals. For Picture A you can write $1\frac{4}{8}$ and $\frac{12}{8}$.

Write with numerals.

A three fifths
B one and one half
C thirteen eighths
D three and eleven sixteenths
E four and seven tenths
F fifteen fourths
G seven and eleven twelfths

Read. 4

A	B	C	D	E	F
$2\frac{3}{4}$	$\frac{17}{10}$	$\frac{14}{5}$	$3\frac{1}{16}$	$3\frac{7}{12}$	$\frac{19}{8}$

G	H	I	J	K	L
$\frac{15}{7}$	$1\frac{7}{16}$	$1\frac{1}{2}$	$\frac{13}{5}$	$3\frac{3}{12}$	$\frac{14}{9}$

M	N	O	P	Q	R
$5\frac{1}{8}$	$1\frac{9}{10}$	$\frac{21}{16}$	$1\frac{11}{16}$	$2\frac{3}{5}$	$\frac{18}{12}$

Now you should understand the numerals that mean whole things and also fractions of the same things.

219

219

1 Teach this picture orally. First have the children note that each object is divided into the same number of equal parts and tell what this number is [8]. Then have them note that one object is completely red and give this number [1]. Now have them tell what part of the remaining object is colored red [$\frac{1}{2}$ or $\frac{4}{8}$]. This gives the mixed number response for the picture. Finally, have them count the total number of equal parts in all that are colored red in this picture and give the answer as an improper fraction [$\frac{12}{8}$]. This gives the improper fraction response.

2 Tell pupils to follow these directions and treat each picture as they did Picture A to find the two answers they should write.

3 Assign these exercises as written work.

4 Let members of the class take turns reading these exercises aloud.

220-221 Moving forward

Expanded Notes for this lesson are on pages 325-326.

Objectives

The child learns to apply his knowledge about fractions to make measurements expressed in fractional parts of an inch.

Vocabulary

There are no new words.

Comments

One special use of fractions that the child encounters in his everyday life and in his schoolwork is in measurement involving fractional parts of an inch. This lesson develops necessary understandings and provides practice in measuring objects by using fractional parts of an inch.

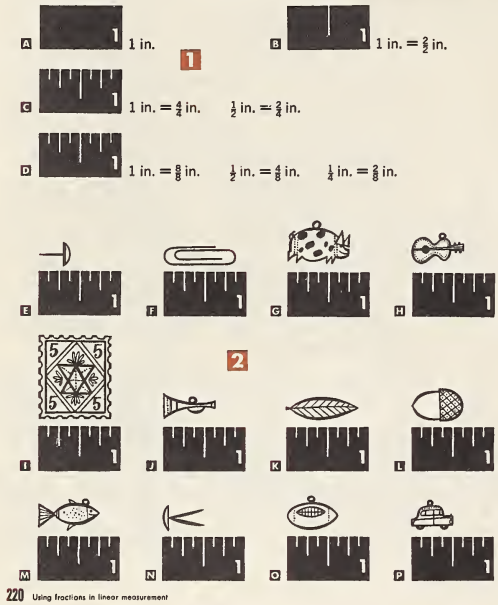
You will note that the pictured objects being measured are all life size. Included are the toy charms found on bracelets. You may want to have the children bring in small objects so that they can measure real things in fractional parts of an inch. The children should have their own rulers. The rulers they use should not be graduated to more than eighths of an inch. For those children who do not have such rulers, the ruler printed at the bottom of page 221 may be useful. The pupils can put their objects beside it and measure them.

The children should develop the ability to approximate lengths of $\frac{1}{2}$ of an inch and $\frac{1}{4}$ of an inch. To help them, you can let them judge the length or width of small things found about the room; then let them compare such estimations with the result of using an actual measuring instrument.

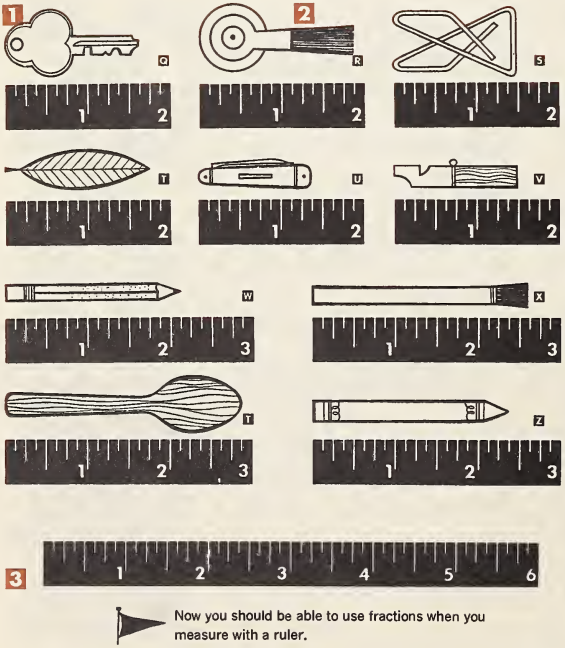
The objects being measured on page 220 are all less than 1 inch in length. Those on page 221 are more than an inch. The measurement of these latter objects can be used to give children more experiences with equivalent fractions, too.

Moving forward

Now you will learn how fractions are used when you measure with a ruler.



220 Using fractions in linear measurement



Now you should be able to use fractions when you measure with a ruler.

221

220

1 Have children notice how the inch looks when it is divided into two equal parts in B. Help them see that each part is $\frac{1}{2}$ of an inch and that the dividing line is a mark used to show $\frac{1}{2}$ of an inch. For C, help them see that each half inch has been divided into two equal parts. Have them count the number of equal parts now in an inch. Tell them that there is $\frac{1}{4}$ of an inch between each mark. For D, help them see that each fourth has been divided into two equal parts. Have them count the number of eighths in the whole inch, a half inch, and in a fourth of an inch.

2 Let the children tell how long each of the objects being measured in Pictures E to P is. Show them how to count the marks from left to right. In Picture E, for example, they count, "One eighth, two eighths, three eighths," and then say, "The length is three eighths of an inch."

221

1 Help the children see in Picture Q that the key measures 1 whole inch and a fraction of the second inch. Help them see this additional fraction as $\frac{5}{8}$ of an inch and that the total length of the key is $1\frac{5}{8}$ inches. You might also ask them to check to see if the key measures $\frac{13}{8}$ inches.

2 Continue around the class, giving children opportunities to measure the objects shown in Pictures R to Z.

3 Have children compare this 6-inch ruler with their own rulers. If they have foot rulers, help them conclude that this is one half of a foot. Then let children measure various small objects, either with their own rulers or by putting the objects alongside this ruler.

222 Thinking straight

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns that the equality of fractional parts does not depend upon the shape of the part. He also learns that the same numeral may be used to represent fractions of unequal things.

Vocabulary

New words page 222 shape*

Comments

The children must understand that the terms "one half," "one fourth," etc., are not restricted to use with a particular size or shape. It is rather common for children to have two misconceptions about fractional parts. For example, children may think that equal fractional parts of objects must all be alike in shape. Thus, they believe that squares may be divided into fourths only as in Figure A or only as in Figure B. Children must learn that it does not matter what shape the fractional part is as long as the parts of the same object are equal. Also, children may not understand that one fourth of something may be very small or very large, depending on the size of the object that was divided into fractional parts. They must be helped to see that the idea of fraction involves the relation of a part to the whole. It is the *relative* size that is being considered, not the *actual* size of either the part or the whole.

An excellent way of getting the children to see these things is to let them draw simple geometric figures, divide them into equal parts, and cut them apart so that the segments may be superimposed. Let them use rulers and various sized circular objects to draw figures.

Answers

A No. Yes B Yes. No C No. No D Yes. $\frac{1}{8}$

E Yes. They are each $\frac{1}{8}$ of equal sized squares.

F No. The two papers in each set of pictures are not always divided into the same number of equal parts (O, P, and Q are not).

G No. The two papers in each set of pictures are not always the same size (M is not).

H Yes I No J Yes

Thinking straight

A In the top row, the pieces of paper are all the same shape and size. Each red part is one fourth of the piece. Are all the fourths the same shape? Are all the fourths the same size?

B In the second row of pictures, are all the pieces of paper the same shape? Are they all the same size?

C In the second row, each red part is also one fourth of each piece of paper. Are all the fourths the same shape? Are they all the same size?

D Can you use the same numeral to tell what part of each piece of paper in Picture L below is yellow? If so, what numeral would you use?

E Are the two yellow parts in Picture L equal in size? How do you know? 4

F Look at each set of pictures below. Are you sure that you can use the same numeral to tell what part of each piece of paper is yellow? Why? 5

G Look at each set of pictures below again. Are you sure that the yellow parts of each piece of paper are the same size? How do you know?

H Are all one fourths of the same thing the same size? 6

I Are all one fourths of different things the same size?

J Are all one thirds of the same thing the same size?

22

222

1 Let the children discuss Pictures A to E and answer the questions in Exercise A. Be sure they give reasons for their answers. Special attention should be given to Pictures C and E. Have pupils make drawings similar to the pictures, cut them apart, and superimpose the sections.

2 Use the same procedures. Let pupils make drawings similar to Pictures J and K and cut them apart to verify that the parts are equal.

3 Encourage active discussion of C.

4 Permit adequate discussion of this exercise. Be sure the children understand why the two yellow segments in Picture L are equal in size though different in shape.

5 Use similar methods with Exercises F and G.

6 The children should support their answers to Questions H, I, and J by referring to the pictures. These answers are generalizations of the ideas developed in this lesson.

223-224 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving problems of the types taught in this book.

Vocabulary

New words page 223 side*, bone, baked*, trip*

Comments

This set of problems is similar to previous "Using arithmetic" sections, as are the exercises in the "Keeping skillful" section. The same procedures used with the earlier problem sets and exercises should be used here.

Answers

Using arithmetic:

A $2 \times \$.75 = [\$1.50]$
B $32 - 18 = [14]$
C $6+4+5+3 = [18]$
D $50 - 35 = [15]$
E $\$1.85 + \$.69 = [\$2.54]$ or $\$.69 + \$1.85 = [\$2.54]$
F $\$.87 \div [\$.29] = 3$
G $12 \div 4 = [3]$
H $24 - 16 = [8]$
I $24 - [11] = 13$
J $15 + 18 = [33]$
K $36 \div [9] = 4$
L $[7] + 9 = 16$
M $25 - [16] = 9$
N $[108] - 72 = 36$
O $8 \div 4 = [2]$
P $[17] + 18 = 35$
Q $\$.75 + [\$3.25] = \$4.00$
R $72¢ \div 6¢ = [12]$

Keeping skillful:

(block 1)
A 2453
B 124
C 1194
D 1029
E 1000
F 182
G 1166
H 257
I 568
J 1650
K 992
L 194
M 1161

(block 2)
A 71
B $93.48
C 94
D 806
E 177
F 89
G 5394
H 129
I 93
J $17.85
K 684
L 200
M 17 and 1 rm.
N 16,224

(block 3)
A 29
B 20 and 4 rm.
C 54 and 4 rm.
D 17
E 25
F 53
G 18 and 4 rm.

(block 4)
A 65 and 3 rm.
B 46
C 63 and 9 rm.
D 37
E 42 and 4 rm.
F 19 and 14 rm.

Using arithmetic 1

A One weekend Bill and Ellen Young helped around the house. Mr. Young paid each of them $.75. How much did the 2 children earn?

B Ellen helped her mother by taking her baby sister for a ride in her buggy. As she walked with the baby, she counted 32 cars and 18 trucks going by. She counted how many more cars than trucks?

C Bill helped his father wash windows. There were 6 windows on one side of the house, 4 on the second side, 5 on the third side, and 3 on the fourth side. There were how many windows in all to wash?

D It took Bill's father 50 minutes to wash the windows on three sides of the house. It took Bill 35 minutes to wash them on one side. Bill spent how much less time washing windows than his father did?

E Ellen and Bill went to the pet store to buy a collar and a dish for their dog. The collar cost $1.85. The dish cost 69¢. How much did these two things cost?

F They also bought 3 rubber bones for their dog. The 3 bones cost $.87 in all. How much did each bone cost?

G Ellen washed dishes for her mother. She washed 12 plates and 4 cups. She washed how many times as many plates as cups?

H Mrs. Young baked 24 cupcakes. 16 of the cupcakes she baked were chocolate, and the rest were plain white cupcakes. How many plain white cupcakes did she bake?

I Ellen helped frost the 24 cupcakes. After she had frosted some of them, there were 13 left to frost. How many had she frosted?

J Bill took shoes to the shoemaker for his father. It took him 15 min. to walk to the shoemaker's and 18 min. to walk back. How long in all did it take him to make the trip?

K It took Ellen 36 minutes to make 4 beds for her mother. She spent about the same amount of time making each bed. About how long did it take her to make one bed?

L Bill and his father raked leaves in the yard. Bill picked up some baskets of leaves in the morning. In the afternoon he picked up 9 more baskets. In all he picked up 16 baskets of leaves. How many had he picked up in the morning?

223

1 Without previous discussion, ask the children to work Problems A to R (M to R are on page 224). Direct them first to write the equation with the screen for the unknown number, then compute, and, finally, rewrite the equation with the answer in place of the screen. Have them label their problems with the identifying letters used in the book.

L Mrs. Young told Ellen to look at some magazines and to throw away the old ones. Of the 25 magazines Ellen looked at, she kept 9. How many did she throw away?

M Mrs. Young wrapped a birthday present for a friend. After she had used 72 in. of ribbon from a spool, she found she had 36 in. left. How much ribbon was on the spool at first?

O Mrs. Young asked Ellen to help her set the table for the evening meal. Ellen needed 4 forks and 8 spoons for the table. She needed how many times as many spoons as forks?

P Ellen put some pictures in her scrapbook. She put some pictures in the scrapbook before lunch, and she put in 18 more after lunch. In all, she put 35 pictures in the scrapbook. How many had she put in before lunch?

Q A small camera that Ellen wanted to buy cost $4.00. How much money did she need to put with the 75¢ that she had earned so that she could buy the camera?

R Bill spent 72¢ of the money that he had earned for colored pencils. Each pencil cost 6¢. How many colored pencils did Bill buy?

1

2 Keeping skillful

Find the sum.

A 892, 643, 918
B 28, 16, 43, 37
C 606, 125, 463
D 711, 233, 85
E 540, 300, 160
F 81, 38, 19, 44
G 361, 288, 517
H 14, 86, 92, 65
I 473, 28, 67
J 916, 434, 300
K 638, 245, 109
L 21, 54, 86, 33
M 518, 349, 294

A ■ + 829 = 900
B 38 × $2.46 = ■
C 846 ÷ ■ = 9
D 1170 − 364 = ■
E 462 − ■ = 285
F 614 + ■ = 703
G 62 × 87 = ■
H 317 − ■ = 188
I 744 ÷ ■ = 8
J 17 × $1.05 = ■
K ■ − 281 = 403
L ■ + 317 = 517
M 69 ÷ 4 = ■
N 39 × 416 = ■

A 87 ÷ ■ = 3
B 124 ÷ 6 = ■
C 490 ÷ 9 = ■
D 68 ÷ ■ = 4
E 175 ÷ 7 = ■
F 424 ÷ ■ = 8
G 94 ÷ 5 = ■

A 1563 ÷ 24 = ■
B 874 ÷ 19 = ■
C 891 ÷ 14 = ■
D 888 ÷ 24 = ■
E 2734 ÷ 65 = ■
F 1040 ÷ 54 = ■

3

224

1 Let the children check their work on Problems A to R (A to L are on page 223) by comparing it with the equations and answers you provide for them. Discuss thoroughly any problems that caused trouble for a majority of the children.

2 You may use all four of these blocks of exercises or select the blocks that will give the children the type of practice they need most. Be sure to provide answers so that the children can verify their work, and discuss any exercises that cause trouble.

3 Omit this block of work if division by two-figure numbers has not been taught.

225 Side trip; Keeping skillful

Expanded Notes are not considered necessary for these lessons.

Objectives

The child learns Roman numerals from I through XXXIX. He also practices the four processes.

Vocabulary

New words page 225 letters*, Roman

Comments

Although the child will encounter Roman numerals only rarely and in a few very restricted situations, he should, of course, be able to read and interpret them. In this lesson he is taught Roman numbers to XXXIX only. All the numerals through 39 can be made by using three letters, I, V, and X. Here the child is introduced to these Roman numerals and is taught to recognize them and write them. The principles of the Roman number notation will be taught in a later grade. You might point out that Roman numerals were used primarily for counting and labeling.

Answers

Side trip:

(block 2)
A 4
B 12
C 34
D 15
E 3
F 8
G 19
H 26

(block 3)
A XXIV
B XVI
C VII
D XXXIII
E XIII
F IX
G XXVIII
H V

I XXV
J XXXVI
K IV
L XIX
M XXXIX
N XX
O XV

Keeping skillful:

(block 1)
A 52 and 8 rm.
B 54
C 14 and 1 rm.
D 80
E 76 and 1 rm.
F 19

(block 2)
A 215
B 81
C 86
D 714
E 123
F 166
G 5622
H 207
I 678
J 3027
K 21
L 821

(block 3)
A 15 and 22 rm.
B 40 and 3 rm.
C 3 and 32 rm.
D 10 and 30 rm.
E 40
F 16 and 15 rm.

Side trip

1

A Look at the picture. Letters are used for numerals. Numerals like these are called Roman numerals.

B Look at the numerals below. What is the Roman numeral for 1? For 5? For 10?

2

C Find the Roman numeral for 4. Find the Roman numeral for 6. How are these numerals different?

3

I	1	VI	6	XX	20
II	2	VII	7	XXI	21
III	3	VIII	8	XXII	22
IV	4	IX	9	XXX	30
V	5	X	10	XXXI	31

D Read the numerals in the picture. 4

E What is the Roman numeral for 20? This numeral means 2 tens. XXI, or 21, means 2 tens and 1. XXII, or 22, means 2 tens and 2. Now write the Roman numerals for 21 to 29. 5

F What is the Roman numeral for 30? This numeral means 3 tens. XXXI, or 31, means ■ tens and ■. XXXII, or 32, means ■ tens and ■. Now write the Roman numerals for 31 to 39.

G XI means 1 ten and 1, or ■. Now write the Roman numerals for 11 to 19. 6

Read these Roman numerals. 7

A IV B XII C XXXIV D XV
E III F VIII G XIX H XXVI

Write with Roman numerals. 8

A 24 B 16 C 7 D 33 E 13
F 9 G 28 H 5 I 25 J 36
K 4 L 19 M 39 N 20 O 15

Keeping skillful 9 10

9

A	476 ÷ 9 = ■	A	■ + 385 = 600	G	6800 − 1178 = ■
B	378 ÷ ■ = 7	B	217 − 136 = ■	H	■ + 107 = 314
C	29 ÷ 2 = ■	C	35 + ■ = 121	I	■ − 255 = 423
D	640 ÷ ■ = 8	D	■ − 412 = 302	J	3712 − 685 = ■
E	305 ÷ 4 = ■	E	36 + 87 = ■	K	■ + 89 = 110
F	114 ÷ ■ = 6	F	209 − ■ = 43	L	684 + 137 = ■

10

A	382 ÷ 24 = ■	D	610 ÷ 58 = ■
B	763 ÷ 19 = ■	E	680 ÷ 17 = ■
C	161 ÷ 43 = ■	F	591 ÷ 36 = ■

225

225

1 Direct attention to the picture and read Exercise A. Ask the children where they have seen Roman numerals. Explain why they are so called.

2 Read and discuss this exercise. Write the three letters I, V, and X on the board. Be sure the children know what each stands for.

3 Let the children discover by using this table that the other numerals are made by combining these letters.

4 Use Exercise D orally.

5 Be sure the children understand that the numbers in the 20 decade are made by using two X's followed by the numerals through nine. Let them discover the same for the 30 decade.

6 This may be done on the board or on paper.

7 Let the children take turns reading these.

8 These may be done on paper or on the board.

9 Use these exercises for written work.

10 These exercises are for those pupils who have learned to divide by two-figure numbers.

226-227 Moving forward

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns about the mile.

Vocabulary

New words page 226 mile*, clocks*, lives*, step*; page 227 train*

Comments

The child's idea of the mile should be closely related to familiar distances in his environment. When the child thinks of a mile, he should not only have a reasonably accurate idea of the distance, but he should also have some idea of the time it takes to cover that distance in familiar ways such as by walking, riding in an automobile in town and on the highway, traveling by streetcar or bus, or by train. The pictures and activities in this lesson have been designed to help him think in this way.

Discuss in class the number of blocks to the mile in your town, and have the children work out distances in their own neighborhoods of about a mile—from their homes to the school, a certain store, the home of a friend, from one street or road to another, from the school to the library or church, etc. Encourage the children to establish several such sets of familiar places that are a mile apart and let them discuss them in class. Then ask children to find out how long it takes them to walk these distances at their normal rate.

Have them compare the length of time it would take to travel the same distance by foot with the time it would take to travel it by automobile or bicycle. Some references might be made to the automobile odometer as an instrument for recording the number of miles traveled and to the speedometer as an instrument for showing the speed, which depends upon the time it takes to travel a mile.

The children should learn one new fact in this lesson. That is, that a mile is 5280 feet. The number of yards in a mile is also given. In this lesson the children also begin to compute, using distances.

Answers

Moving forward:

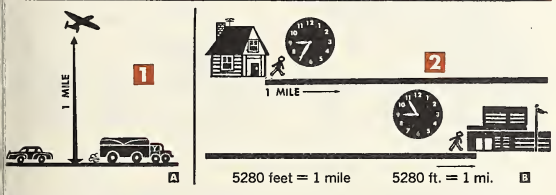
A 1 mile
B 1 mile
C 20 minutes
D —
E —
F 2 feet
G Yes. He had walked 5280 feet.
H —
I Yes. It is 5289 feet long.
J Yes. There are 3 feet in a yard and $3 \times 1760 = 5280$.
K 6 miles
L 12 miles
M 6 miles; 2 miles
N 4 miles

Keeping skillful:

(block 1)	(block 2)	(block 3)
A 29	A 5040	A 245
B 34 and 6 rm.	B 4598	B 5799
C 68 and 8 rm.	C 3745	C 44
D 30 and 1 rm.	D 3784	D 1288
E 93	E 13,440	E 2640
F 64	F 4800	F 647

Moving forward

Now you will learn something new about measurement. You will learn about the mile.



A In Picture A, how high is the airplane flying?

B Picture B shows Tony's home and school. How far does Tony have to go to school?

C The clocks in Picture B show the time when Tony left home and when he got to school. How long did it take Tony to walk the mile to school?

D Where Tony lives, 8 blocks are equal to 1 mile. How many blocks equal 1 mile where you live?

E About how long does it take you to walk 1 mile?

F Picture C shows the length of Tony's step. His step is about how long? 3

G Picture C also shows what Tony used to count his steps one day. By noon he had taken 2640 steps. If each step was about 2 ft. long, had he walked about 1 mile? How do you know? 4

H Each of your steps is about how long?

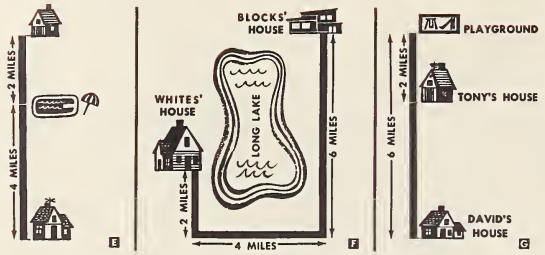
226

1 Discuss what a plane looks like from the ground when it is flying a mile high. Ask pupils how a plane would look from the ground if it were two or three miles in the air. If any of them have flown, let them tell about it.

2 Let the children look at the picture and discuss Questions B through E. Be sure each child has a good idea of how long a mile is in terms of at least one familiar distance and knows about how long it takes him to walk one mile.

3 Have children answer Questions F and G.

4 Have the children measure the length of their normal walking step and figure out about how many steps they would take in a mile. All the computation should be very approximate and not involve any fractions. Get them to see that they do not need to know exactly how many steps they take in a mile, that this is a situation in which an approximation is adequate.



1 I There are 123 cars in the train in Picture D. Each car is 43 feet long. Is the train about 1 mile long? How do you know?

2 J There are 1760 yards in a mile. Is this equal to 5280 feet? How do you know?

3 K Look at Picture E. The red house is how far from the yellow house?

L Now look at Picture F. John rode his bicycle from the Whites' house to the Blocks' house. How many miles did he ride?

4 M In Picture G, David's house is how far from the playground? Tony's house is how far from the playground?

N David's house is how far from Tony's house?

Now you should know what we mean by a mile.

Keeping skillful 5

A $87 \div \square = 3$	A $60 \times 84 = \square$	A $\square + 1235 = 1480$
B $244 \div 7 = \square$	B $242 \times 19 = \square$	B $6613 - 814 = \square$
C $620 \div 9 = \square$	C $35 \times 107 = \square$	C $56 + \square = 100$
D $61 \div 2 = \square$	D $88 \times 43 = \square$	D $817 + 396 + 75 = \square$
E $465 \div \square = 5$	E $240 \times 56 = \square$	E $\square - 1202 = 1438$
F $384 \div \square = 6$	F $12 \times 400 = \square$	F $911 - \square = 264$

227

227

1 Have pupils find the answer to Question I.

2 Discuss with the children how they would find the number of yards there are in a mile. Have them answer the two questions in Exercise J.

3 Let the pupils discuss what they would do to find the answer to Questions K and L, and let them explain why.

4 Ask the children to answer Questions M and N and to explain how they found their answers. If necessary, let them select locations along one side of the room to represent the playground, Tony's house, and David's house, and use these locations to help explain their answer to Exercise N.

5 Tell the children to find the answers. Let them verify their work from answers furnished by you. Then discuss any examples that caused trouble.

228-229 Moving forward

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns about the ton.

Vocabulary

New words page 228 ton, elevator*, bridge*; page 229 coal*

Comments

The essential thing for the children to learn in this lesson is that a ton of one material is not necessarily the same bulk as a ton of another material and that a given amount in weight of a "heavy" material is less in bulk than the same amount in weight of a "light" material.

The first three pictures on page 228 show the differences in bulk of a ton of hay, of coal, and of stone. There should be some discussion of what materials are weighed in tons. Discuss also why load limits are put on elevators, bridges, streets, etc.

Answers

Moving forward:

A Pile A; Pile C

B Because hay is lighter than coal, and it takes a larger pile to make the same amount by weight.

C Because the materials are different.

D No E No F No

G No. Because it is too heavy for the bridge.

H It is 3 tons too heavy. It is 6000 pounds too heavy.

I 6000 lb. J Yes. Because a ton is 2000 lb. K 5 tons.

L Yes. Because the weight of the truck and the coal is exactly the same as the load limit.

M 5990 lb. N More; 3990 lb. O 10,000 lb. More

P No. Because it weighs more than 5 tons.

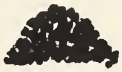
Keeping skillful:

A 573	F 203	K 4350
B 33,120	G 13 and 4 rm.	L 218
C 810	H 238	M 649
D 681	I 47	N 167
E 72 and 4 rm.	J 4862	O 95

Moving forward

On pages 228 and 229 you will learn more about everyday uses of measurement.

1 ton A



2000 pounds = 1 ton B

2000 lb. = 1 T. C

D

A Each pile in Pictures A, B, and C weighs 1 ton. Which pile is largest? Which is smallest?

B Why is the pile in Picture A larger than the pile in Picture B?

C Why are all the piles different in size?

D Should the elevator in Picture D carry as much as 1½ T.?

E Imagine that each person in the elevator weighs 175 lb. Is the elevator carrying too many persons?

F Should the elevator carry as many as 12 persons? Again imagine that each person in the elevator weighs 175 lb.

E

G In Picture E the truck and the stone together weigh 16,000 lb. Should the truck go over the bridge? Why or why not?

H The truck is how many tons too heavy for the bridge? The truck is how many pounds too heavy?

F

G

I The coal truck in Picture F weighs how many pounds?

J Does the truck weigh exactly 3 T.? How do you know?

K Imagine that the truck has 2 tons of coal in it. How much would the truck and the coal weigh altogether?

L Should this truck with the coal go over the bridge shown in Picture E? Why or why not?

M Look at Picture G. How many pounds of coal are in the truck?

N Is this amount of coal more than or less than 1 ton? How much more or less than 1 ton is it?

O How many pounds are there in 5 tons? Do the truck and the coal together weigh more or less than 5 tons?

P Should the truck go over the bridge shown in Picture E? Why or why not?

Now you should know how the ton is used in measurement.

Keeping skillful

A $36 + 117 + 420 = \square$

B $720 \times 46 = \square$

C $\square - 621 = 189$

D $840 - 159 = \square$

E $364 \div 5 = \square$

F $\square + 197 = 400$

G $95 \div 7 = \square$

H $300 - \square = 62$

I $63 + \square = 110$

J $\square - 762 = 4100$

K $50 \times 87 = \square$

L $\square + 212 = 430$

M $758 - \square = 109$

N $642 + \square = 809$

O $855 \div \square = 9$

228

1 Use Exercises A to C to have the children arrive at the conclusion that tons of different materials will vary in bulk, according to whether the material is "light," like hay, or "heavy," like stone. Also discuss what is weighed in tons and what is weighed only in pounds. The children might watch for references to tons in the newspapers.

2 Use Exercises D to F to establish the idea of load limits in elevators. Ask the children why there are load limits, and develop the safety aspects of this question. Let them figure out how many children could ride in the elevator in Picture D.

3 Discuss weight limits on bridges, using Picture E and Exercises G and H. Let the children talk about bridges in their neighborhoods or ones that they have seen or know about, and whether or not they have weight limits and why.

229

1 Have the children answer Questions I to N. Get them to see that they can find the weight of the load on a truck or other vehicle by weighing it empty, then loading it and weighing it with the load, and then subtracting the two weights. Ask the children to watch for trucks in their neighborhoods and to notice any markings on them that tell how much the trucks can haul.

2 Let the children answer Questions O and P.

3 After the children have worked these exercises, supply answers for them to verify their work.

230-231 Moving forward

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns more about liquid measures. He learns the meaning of the fluid ounce and the tablespoon in terms of the cup, pint, and quart.

Vocabulary

New words page 230 fluid

Comments

In everyday experiences the child frequently encounters situations in which the fluid ounce is used. Cans and bottles of juices from the grocery store are labeled in this way, medicine is measured by the fluid ounce, and many measuring cups and bottles are marked in ounces. The tablespoonful should also be a familiar measure because of its frequent use in cooking.

In this lesson the child learns the equivalents of tablespoonfuls to fluid ounces, and of fluid ounces to cups, pints, and quarts. The cup used here is the standard eight-ounce measuring cup, of course, and the distinction between it and the tea cup or coffee cup for table use must be made clear. Ask the children to find out how much the drinking cups they use at home hold (usually about six ounces), and establish the difference between the capacity of those cups and the standard measuring cup. Have available in the classroom measuring cups marked in ounces and also in fractions of a cup, a tablespoon (part of a set of standard measuring spoons), some bottles of one-ounce and two-ounce capacity, and an assortment of pint and quart containers. Let the children practice judging capacity in terms of ounces, cups, pints, and quarts. Be sure the children do not confuse the fluid ounce with the weight ounce. Tell them that a fluid ounce of water weighs an ounce, but that this is not necessarily true of other liquids. Some fluid ounces of other things weigh more or less than an ounce.

Answers

(block 1)

A 2 B 12 C 8 D 16 E In ounces

F Not in the picture, but you can look at the large picture of the one-ounce bottle above and see that one tablespoonful of liquid has been poured into it and see that in the small picture below, the bottle has been emptied into the cup. So the cup has one tablespoonful or one-half ounce of liquid in it.

G In halves and quarters of a cup

H In thirds of a cup I More

J 2 cups = 1 pint; 16 fluid ounces.

K 18 fluid ounces L 30 tbs.; more; 7 oz. more

M 26 fluid ounces N 6 fluid ounces; less

O 12 tablespoonfuls

P 6 pints; 12 cups; 96 fluid ounces

Q 32 fluid ounces; 46 fluid ounces

(block 2)

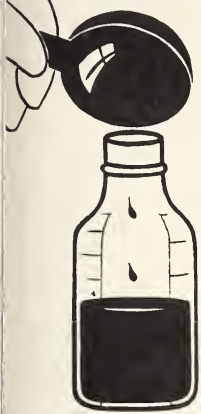
A 2 D 10 G 4 J 64

B 6 E 16 H 3

C 2 F 32 I 4

Moving forward

In this lesson you will learn more about how liquids are measured.



2 tablespoonfuls = 1 fluid ounce
2 tbs. = 1 fl. oz.

1 A The bottle in Picture A holds 1 fluid ounce. How many tablespoonfuls does it hold?

A B How many tablespoonfuls would fill a 6-ounce bottle?

C Look at Picture B. How many fluid ounces would fill 1 cup?

D How many tablespoonfuls would fill 1 cup?

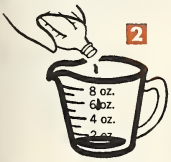
E How is the first cup marked?

F Can you tell exactly how much has been poured into the first cup?

G How is the second cup marked?

H How is the third cup marked?

I Is one third of a cup more than or less than one fourth of a cup?



2

8 fluid ounces = 1 cup

8 fl. oz. = 1 c.

230 Liquid measures: the tablespoonful, the fluid ounce

2 cups = 1 pint 2 c. = 1 pt. C

J Look at Picture C. How many cups equal 1 pint? One pint equals how many fluid ounces? 1

K How many fluid ounces will the can in Picture D hold?

L How many tablespoonfuls would fill the can in Picture E? Is that amount more than or less than 1 cup? How much more or less is it?

M How many fluid ounces will the can in Picture F hold?

N In Picture G, how many fluid ounces does the can hold? Does it hold more than or less than 1 cup?

O How many tablespoonfuls will the can in Picture G hold?

P Look at Picture H. How many pints will this can hold? How many cups will it hold? How many fluid ounces will it hold?

Q Look at Picture I. There are how many fluid ounces in a quart? How many fluid ounces will this can hold?

1 pt. 2 fl. oz. D

15 fl. oz. E

1 pt. 10 fl. oz. F

6 fl. oz. G

3 qt. H

1 qt. 14 fl. oz. I

A 4 c. = ▩ pt. 2
B ▩ pt. = 12 c.
C 16 fl. oz. = ▩ c.
D ▩ c. = 5 pt.
E 8 fl. oz. = ▩ tbs.
F 4 c. = ▩ fl. oz.
G ▩ fl. oz. = 8 tbs.
H ▩ c. = 24 fl. oz.
I 16 c. = ▩ qt.
J 16 qt. = ▩ c.

Now you should understand the fluid ounce and the cup as they are used in measurement.

231

230

1 Have the children answer Exercises A and B. If they need to use pencil and paper to work out any of the equivalents in these exercises, let them. If possible, have medicine bottles of various sizes in the classroom and use them to give the children experiences in measuring tablespoonfuls and ounces. Be sure that the children understand that the hand, tablespoon, and one-ounce bottle in Picture A are life size.

2 Be sure the children realize that the bottle and hand in Picture B are the same as those in Picture A, only on a smaller scale. Make clear, by using real containers, that there is a difference between a standard measuring cup, such as shown here, and an ordinary coffee cup or tea cup. Let the children answer and discuss Exercises C to I.

231

1 To help the children answer and discuss Exercises J through Q, use containers of various sizes as much as possible to supplement the pictures and text. Permit children to use pencil and paper to work out the answers to the questions if they need to.

2 Ask the children to write the answers to Exercises A to J. Then let them verify their work and discuss any exercises that caused difficulty.

232-233 Moving forward

Exponded Notes ore not considered necessory for this lesson.

Objectives

The child learns the meaning and use of the dry measures pint, quart, peck, and bushel.

Vocabulary

New words page 232 dry*, peck, bushel*; page 233 potatoes*

Comments

Dry measures such as pints, quarts, pecks, and bushels are no longer in wide use. However, children do need to know about them because they will see references to them in reading. Children who live on farms will find dry measures still in use and the names of these measures a part of their everyday speaking vocabulary.

Most of the material that is measured in dry measures is really weighed. State laws define the legal weight of a bushel of the different kinds of products in terms of pounds, and these weights may vary from state to state. Children must understand that there is a difference in capacity between dry pints and liquid pints and dry quarts and liquid quarts. The dry units are larger.

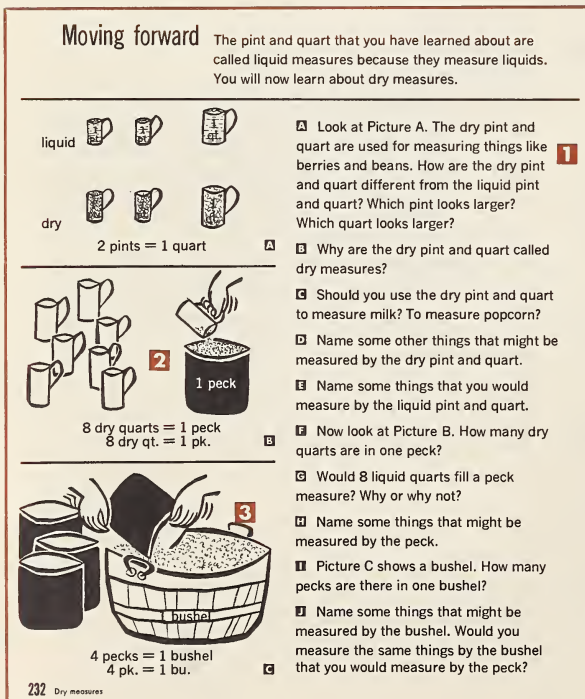
Answers

(block 1)

A They are larger. The dry pint; the dry quart
B They measure dry materials. C No. Yes
D Blueberries, currants, strawberries, gooseberries, etc.
E Milk, ice cream, cider, paint, gasoline, etc.
F 8 qt.
G No. Each liquid quart is smaller than a dry quart.
H Potatoes, apples, onions, etc. I 4 pk.
J Oats, wheat, etc. Yes K 32 qt. L 64 pt.
M 15 lb. No. The size of the potatoes may vary.
N 61 lb. Yes
O 49 lb. No. The apples may vary in size and weight.
P They can be measured more accurately in pounds.

(block 2)

A 16	E 4	I 25	M 8	Q 64	U 16
B 1	F 112	J 24	N 3	R 5	V 60
C 32	G 2	K 4000	O 128	S 40	
D 1	H 144	L 4	P 32	T 16	


Moving forward
The pint and quart that you have learned about are called liquid measures because they measure liquids. You will now learn about dry measures.
liquid
dry
2 pints = 1 quart
A
2
1 peck
8 dry quarts = 1 peck
8 dry qt. = 1 pk.
B
3
1 bushel
4 pecks = 1 bushel
4 pk. = 1 bu.
C
A Look at Picture A. The dry pint and quart are used for measuring things like berries and beans. How are the dry pint and quart different from the liquid pint and quart? Which pint looks larger? Which quart looks larger?
1
B Why are the dry pint and quart called dry measures?
C Should you use the dry pint and quart to measure milk? To measure popcorn?
D Name some other things that might be measured by the dry pint and quart.
E Name some things that you would measure by the liquid pint and quart.
F Now look at Picture B. How many dry quarts are in one peck?
G Would 8 liquid quarts fill a peck measure? Why or why not?
H Name some things that might be measured by the peck.
I Picture C shows a bushel. How many pecks are there in one bushel?
J Name some things that might be measured by the bushel. Would you measure the same things by the bushel that you would measure by the peck?
232 Dry measures

232

1 Use Questions A to E orally to help pupils conclude that dry measures are larger than liquid measures and to discover some of the things that are measured by each.

2 With the aid of Picture B and Exercises F, G, and H, help pupils to discover that 8 dry quarts equal 1 peck and to consider what things might be measured in pecks.

3 Let pupils look at Picture C to discover that 4 pecks equal 1 bushel. Then have them answer Exercises I and J.

K Look at Picture D. The large box holds 1 bushel. There are how many dry quarts in a bushel?

L How many dry pints are there in a bushel?

M Look at Picture E. How much does the peck of potatoes weigh? Would there always be the same number of potatoes in a peck? Why do you think so?

N How much does the bushel of corn in Picture F weigh? Could a farmer have one full bushel basket of corn that weighed 55 lb. and another bushel basket just as full that weighed 62 lb.?

O How much does the bushel basket of apples in Picture G weigh? Does a bushel basket full of apples always weigh 49 lb.? Why or why not?

P Dry foods like beans and sugar are more often sold by the pound than by the quart, peck, or bushel. Why?

A	4 bu. = ■ pk.	L	1 qt. = ■ c.
B	2000 lb. = ■ T.	M	4 pt. = ■ c.
C	2 pt. = ■ fl. oz.	N	24 fl. oz. = ■ c.
D	32 qt. = ■ bu.	O	4 bu. = ■ qt.
E	8 c. = ■ pt.	P	64 tbs. = ■ fl. oz.
F	7 lb. = ■ oz.	Q	8 c. = ■ fl. oz.
G	16 qt. = ■ pk.	R	20 pk. = ■ bu.
H	36 bu. = ■ pk.	S	5 c. = ■ fl. oz.
I	100 qt. = ■ gal.	T	32 tbs. = ■ fl. oz.
J	3 pk. = ■ qt.	U	8 fl. oz. = ■ tbs.
K	2 T. = ■ lb.	V	5 doz. = ■ things

Now you should understand how dry measures are different from liquid measures.

233

233

1 Identify Picture D as a crate filled with boxes of strawberries, each box holding a quart. Pupils should answer Exercise K by referring to Picture D. To answer Exercise L they may have to refer to both Pictures A and D.

2 Pupils should realize that the weight scale in Picture E shows pound measurements. They should give their answer to Exercise M accordingly.

3 Let pupils use Picture F in answering Exercise N. Encourage discussion of the last question.

4 Tell pupils to get their answer for the first part of Exercise O from Picture G. Let the class discuss the last two parts thoroughly.

5 Class discussion of this exercise should elicit an answer similar to the one given in the answer key.

6 Exercises A to V may be treated orally or as written work.

234-236 Exploring problems

Expanded Notes for this lesson are on pages 327-328.

Objectives

The child learns the meaning of average. He learns to make two equations to solve problems that involve finding the average.

Vocabulary

New words page 234 suppose*, average, per; page 236 spelling

Comments

To find the average usually involves two steps in problem solving. First, the child has to add to find the total amount. When he finds this sum, he must use it in making the equation for the second step. The second equation is a partitive division equation which is used to find the average.

This lesson introduces two-step problems. The two-step problem described above will be the only type presented before Book 5.

It is very important that children understand what is meant when they are asked to find the average, and they should understand this thoroughly before they try to work the first problem on page 235. Example A concerns varying amounts of money that were saved each week for six weeks. The accompanying picture shows six groups or piles of coins arranged according to the amounts as they were saved. The children must see that what they are really trying to find is how much there would be in each pile if the piles were equal in value. You should link this situation with a similar one they have studied in which they knew the number of equal groups but did not know the size of the equal groups. Help the children recall the solution of this type of divisive situation (partitive division). Then point out to them that before they can write an equation of this type, they must know how much money there was altogether. Once they have found this (by means of a simple additive equation), they can use the answer in the divisive equation and get the size of the equal groups, which is what

the average is. If the children have any difficulty setting up an equation for finding the size of the equal groups, you might refer them again to the lesson on partitive division, pages 120 to 123.

Two different kinds of problems involving averages are presented in this developmental lesson. The money problem involves items that can be counted into equal groups. The fish problem involves items that cannot be counted—they must be measured. To help children understand the solution of the fish problem, suggest that they think of all the fish as laid end to end as though there were one long fish so many inches long. Then they can see that they must divide those inches into the required number of parts so that there are pieces, or "fish," all the same length; that is, they must find the number of inches in each equal group.

It is important that the children realize that no one group or thing has to be the same length or size as the average. Thus, in the picture for Problem A, there is no pile of money shown with a value of 9¢, the average that was found.

Answers

Exploring problems:

A $53+54+52+49=[208]$
$208\div[52]=4$

B $68+70+55+63=[256]$
$256\div[64]=4$

C $17+22+21=[60]$
$60\div[20]=3$

D $39¢+25¢+50¢+30¢=[\$1.44]$
$\$1.44\div[\$.36]=4$

E $12¢+10¢+20¢+9¢+14¢=[65¢]$
$65¢\div[13¢]=5$

F $279\div[31]=9$

G $\$3.04\div[\$.38]=8$

H $22+16+25=[63]$
$63\div[21]=3$

I $18+21+24+17=[80]$
$80\div[20]=4$

J $30\div[5]=6$

Keeping skillful:

A 9	D 6000	G 720	J 1315	M 11
B 240	E 20	H 24	K 25	N 216
C 10	F 21	I 7	L 48	O 10

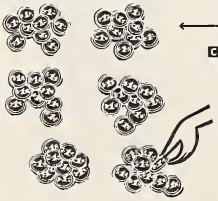
Exploring problems

A Each week for 6 weeks Tony wrote down how much money he had saved that week. He saved 10¢, 6¢, 8¢, 12¢, 10¢, and 8¢. He said to himself, "Suppose I had saved all that money by putting the same amount in my bank each week. How much would I have needed to save each week?" 1

B First find how much money Tony saved in the 6 weeks. Think of the money as pennies.

$10¢+6¢+8¢+12¢+10¢+8¢=\square$ 2

The sum is 54¢.



C Tony saved 54¢ in all. Imagine that he saved the same number of pennies each week. How many pennies did he save each week?

Total number of pennies saved.
Number of weeks.

$54\div\square=6$ 3

Number of pennies he needed to save each week.

54 divided by 6 is 9

The amount Tony would have had to save each week is the average amount. 9¢ is the average. The average is 9¢ a week. The average is 9¢ per week. 4

234

1 Have pupils read Example A and call on them to find in Picture A the groups of coins for each amount. Point out that if Tom had saved the same amount each week, each of the groups would have to be of the same value. Tell pupils they know the number of equal groups but they must find how much would be in each of the equal groups. Ask pupils what kind of problem situation this reminds them of. They should think of division. Have the children note that to divide, they must know the total amount of money saved and that they can find this by combining the groups.

2 Help pupils see that the equation represents the amounts pictured in A and that by adding they can find the total. Picture B shows this sum in pennies.

3 Using the sum found in Step B, pupils can now make the equation and solve it.

4 Have pupils read these statements. Make sure pupils know the meaning of *per* and *average*.

When Bill asked David about his fishing trip, David said, "I caught 7 fish, and they averaged about 11 inches long." 1

A

The fish David caught were 8 in., 12 in., 13 in., 10 in., 11 in., 9 in., and 14 in. long. Why did David say that the average length was 11 inches? He meant that if the fish had all been the same length, each fish would have been 11 inches long.

B

To find the average length of the fish, David made two equations.

What do these numbers stand for?

$8 + 12 + 13 + 10 + 11 + 9 + 14 = \blacksquare$ 2

What does this stand for?

How did David get this number?

What will this number tell you?

$77 \div \blacksquare = 7$ 3

What does this stand for?

The average length of the fish was ■ inches.

A The heights of the boys who live on Bill's block are 53 in., 54 in., 52 in., and 49 in. What is the average height of these boys?

THINK First add their heights. Then divide 208 by 4. How did you get 208? Why do you divide by 4?

B The weights of the 4 boys who live on Bill's block are 68 lb., 70 lb., 55 lb., and 63 lb. What is the average weight of these boys?

THINK What equation must you make first? What should your second equation be?

C Tony, Jim, and Bill timed themselves when they worked a puzzle. Tony worked for 17 min., Jim worked for 22 min., and Bill worked for 21 min. What was the average time it took them to do the puzzle?

D Sue bought 4 prizes for a party. The prizes cost 39¢, 25¢, 50¢, and 30¢. What was the average cost of the prizes?

E Peggy wrote down how much she spent for candy each week for 5 weeks. She spent 12¢, 10¢, 20¢, 9¢, and 14¢. She spent an average of how much per week for candy?

F In nine months the children in the fourth grade missed a total of 279 days of school. On the average, how many days of school were missed per month?

THINK Why do you need to make only one equation for this problem?

G In 8 weeks Don earned a total of $3.04. He earned an average of how much per week? 2

THINK How many equations will you make for this problem? Will the answer tell you exactly how much Don earned in any one of the 8 weeks?

H One Friday Tom had 22 words right on the weekly spelling test. The next Friday he had 16 words right, and the third Friday he had all 25 words right. He had an average of how many spelling words right per week?

I Carol had 18 spelling words right one Friday, 21 words right the next Friday, 24 words right the third Friday, and 17 words right the fourth Friday. What was Carol's spelling average for the 4 weeks?

J In 6 months Sue read 30 books at home. She read an average of how many books per month at home? 2

Now you should understand the meaning of average, and you should be able to find the average. 3

Keeping skillful 4

36 qt. = ■ gal.	F 1 pt. 5 fl. oz. = ■ fl. oz.	K 75 ft. = ■ yd.
15 lb. = ■ oz.	G 6000 ft. = 1 mi. ■ ft.	L 6 c. = ■ fl. oz.
20 c. = ■ pt.	H 3 pk. = ■ qt.	M 44 pk. = ■ bu.
3 T. = ■ lb.	I 14 tbs. = ■ fl. oz.	N 6 yd. = ■ in.
5 bu. = ■ pk.	J 3315 lb. = 1 T. ■ lb.	O 5 fl. oz. = ■ tbs.

235

1. Call on a pupil to read aloud this example and the explanatory material with it.
2. Have pupils study the addition equation. Help them see that they should think of the fish in Picture A laid end to end to find the total length and that this is what the equation represents. When they have found the total length, they then use that number in the next equation.
3. Tell them they can think of this as though it were one fish divided into 7 equal parts, or "fish," the same length and that this is what the equation stands for. After they have discussed this equation, have someone tell how to divide. Let pupils compute on paper if necessary.
4. Discuss Problems A and B orally. Make the equations on the board with the children's help.

236

1. Assign Problems C to J as written work. Tell pupils first to write the equation to show that all the amounts must be put together. They should then find the sum. Then tell them to use this sum in writing the second equation with the screen in the proper place. Insist that they also show the work for division. Tell pupils to be sure to label their answers.
2. Remind the pupils that they may not always need to make the equation for combining the groups because sometimes the total will be known.
3. Give children the answers to the problems and let them verify their own work. Discuss any problems that caused trouble.
4. Assign these exercises as written work. Require the pupils to write the missing numbers.

237 Side trip

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns that numerals can be used not only to tell how much or how many but also to label things and to identify things.

Vocabulary

New words page 237 lake*, road*

Comments

This "Side trip" lesson calls the children's attention to some of the uses numerals have in everyday experiences other than for counting or computing.

One of these uses is for the purpose of identification. Here numerals are used without any relation to the total quantity or position. For example, explain that a numeral such as 80 on a football sweater does not mean that there are 80 players or that the player is the 80th. The numeral is put there only for purposes of identification. Numerals on houses, on streets, etc., of course, do have some relation to the place each house occupies, but in most cases such numerals do not show the exact position, as in a counting situation. Such factors as vacant lots, the end of the block, the placement of odd numerals on one side of the street and even ones on the other, the sizes of the buildings, etc., determine the numerals that do appear. Class discussion should bring out these facts. Other uses of numerals for identification are demonstrated in the pictures in the book. Still others, such as room numbers and floor numbers, may be brought up in discussion.

When a numeral is used for other than counting purposes, it often is read differently than in counting situations. Frequently each figure is named, as when giving telephone numbers or reading house and automobile license numbers. Be sure to remind children that they have already learned different ways of reading four-figure numbers. For example, 5040 may be read five thousand forty, or fifty hundred forty. As a telephone number, it would be read "five-oh-four-oh." Class discussion should also bring out the fact that in print the numerals used for other than counting purposes have dashes instead of commas to separate the parts of the number for easy reading.

Answers

A Picture B shows a house number; Picture C, an automobile license; Picture D, a telephone number; and Picture E, numerals on football sweaters.

B No. Vacant lots and length of blocks determine house numbers.

C "Twenty-five thirty-six," or "twenty-five hundred thirty-six," or "two five three six."

D No. The numerals serve merely as identification.

E "3-oh-4-6-2-2-9." It is easier to read or write down this way—there are no extra words.

F "3-oh-oh-8-7."

G They are easier to say, read, and remember.

Side trip

A Picture A shows a road sign. Tell how the numerals are used in each of the other pictures.

B Does Mr. Brown's house number in Picture B mean that there are 2536 or more houses in his city? How do you know?

C How do you think Mr. Brown says his house number?

D Do you think the football players in Picture E are the twenty-fourth, fifty-sixth, and eightieth boys on their team? Why?

E Look at Picture C. Would you say this numeral "3 million 46 thousand 229" or "3-oh-4-6-2-2-9"? Why?

F Look at Picture D. How would you say the numeral?

G You see that numerals do not always mean how many or how much. Sometimes they are used just as names are used. Why are numerals sometimes used instead of names?

Read these numerals in the different ways you have learned.

A	5040	H	2,071,990
B	6800	I	96,570
C	72,159	J	4111
D	80,320	K	7,009,700
E	1346	L	34,021
F	4,001,708	M	2990
G	1020	N	13,405,730

Numerals used as labels 237

237

1 Have pupils tell how this numeral is used. Apply Exercise A to the remaining pictures.

2 Use Exercises B and C with this picture. Make certain that pupils know how to read this number as twenty-five thirty-six or twenty-five hundred thirty-six.

3 Use Exercise D with this picture. Make sure pupils understand these are numerals used only for identification purposes.

4 Use Exercise E with this picture and discuss also the use of the dash.

5 Use Exercise F with this picture.

6 Help pupils generalize that numerals may be used for identification purposes.

7 Use this exercise orally.

238-239 Side trip

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to identify various plane figures such as a rectangle, square, and triangle. He learns to observe lines that are parallel and angles that are right angles.

Vocabulary

New words page 238 map, apart*, parallel, corners*, angles, rails; page 239 rectangle

Comments

This is one of a series of lessons in this arithmetic program in which the fundamental ideas about plane figures are introduced. Through them the child is gradually prepared for more difficult geometric concepts he will need later. In this lesson he learns to distinguish between the rectangle and other figures that have opposite sides parallel. He learns the special characteristics of rectangles that are called squares. He learns what a triangle is, and he learns what parallel lines are. He learned about the circle in the preceding grade and will learn more about it in the early part of Book 5 in connection with other plane figures.

One of the objectives of such a lesson as this is to get the children to observe and describe their environment in terms of the rectangle, square, and so forth. The map on page 238 shows some of the ways in which these figures commonly occur. Ask the children to make similar diagrams of their own neighborhoods, and to make or remember a list of other things around them that have geometric shapes, such as the square or the rectangle. Examples of such things are doors, windows, desk tops, circular flower beds, etc. In each instance be sure the children understand the elementary properties of the figure they are describing and are able to name it correctly. When this lesson is finished, the children should be able to describe figures in terms of the number of sides they have, to tell whether they have right angles or not, and to identify the rectangle, square, and

triangle. They should also be able to recognize and name parallel lines.

Each child should have a ruler and a piece of paper or card with a square corner. The ruler is used to measure the sides of the figures in the lesson and the card or paper is used to find whether or not angles are right angles. If the children ask what Figures C and D on page 239 are called, satisfy their curiosity by telling them that C is a parallelogram and D is a trapezoid, but do not try to teach either the names or the properties of these figures.

Answers

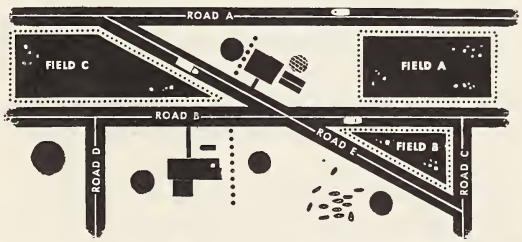
Page 238:

A 5 B Yes C Yes. They are the same distance apart.
D No. It is not the same distance from any of the other roads for its entire length.
E — F No G Roads B and D
H Yes. Each corner is square.
I Yes. Yes J No. Yes K Yes. Two
L Yes. They are the same distance apart for their entire length.

Page 239:

A Four. Yes. Yes. Four
B Four. Yes. All its sides are equal in length.
C Four. Yes. No. No. All rectangles have four right angles.
D Yes. No. No. Rectangles must have two pairs of parallel sides and four right angles.
E Yes
F Accept any triangle that meets the requirements.
G No H [G, K, L, M, O, and P] I [L and P]
J [H, J, and N] K [U and V] L [Q and Y]

Side trip



1 A This map of David's neighborhood was made from an airplane. How many roads are shown on the map?

B Are Roads A and B the same distance apart as far as you can see? These two roads are parallel.

C Are Roads C and D parallel? Why?

D Is Road E parallel to any other road on the map? How do you know?

E Find the place where Road C and Road B join. They make square corners where they join. Square corners are called right angles.

2 F Does Road E make right angles where it joins any other road?

G What other two roads join to make right angles?

H Is each corner of Field A a right angle? How do you know?

I Are the long sides of Field A parallel? Are the short sides of this field parallel?

J Look at Field B. Are any of its sides parallel? Are any of its corners right angles?

K Look at Field C. Are any of its sides parallel? How many of its corners are right angles?

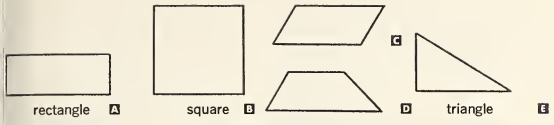
L Are the rails on a railroad parallel? Why? 3

238

1 Have the children use their rulers and cards with the square corners to help them find the answers to the questions on this page. Be sure the children understand that any two straight lines that are the same distance apart for their entire length are parallel.

2 After the children have found the answers to Questions E to K by observing the map and measuring the angles and lines with their rulers and cards, tell them that Field A is a rectangle and Field C is not. Help them to list the characteristics of a rectangle. It has four sides. Its angles are all right angles. Its opposite sides are parallel and the same length.

3 Discuss with the children the fact that railroad tracks look as if they come together at a point in the distance, even though they are really always the same distance apart. Ask them to give other examples of parallel lines.



A Look at Rectangle A above. How many sides has it? Are its long sides parallel? Are its short sides parallel? How many right angles has it?

B How many sides has the square? Are there 4 right angles? How is it different from Rectangle A? A square is a rectangle with equal sides.

C Look at Picture C. How many sides are there? Are any of these sides parallel? Are there any right angles in Picture C? Is it a rectangle? Why or why not?

D Are there any parallel sides in Picture D? Are there any right angles? Is Picture D a rectangle? Why or why not?

E Picture E is a triangle. A triangle has only 3 sides. Has this triangle any right angles?

F Can you draw a triangle that has no right angles? If you can, draw one.

G Can you draw a triangle that has 3 right angles?

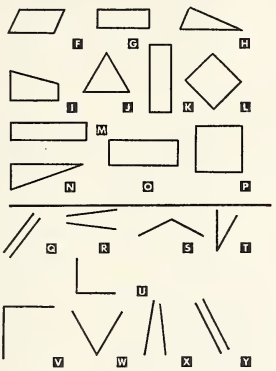
H Find each yellow rectangle below. 5

I Find each yellow square.

J Find each yellow triangle.

K Find each red right angle below.

L Find each set of red parallel lines.



239

239

1 Have the children use their rulers and cards to find the answers to Exercises A and B. They should now realize that the rectangle as they defined it on page 238 also includes the square.

2 Have the children discover that Figure C is like a rectangle in two ways (its opposite sides are equal and parallel) and unlike a rectangle in one way (it does not have right angles). Do not teach the name of the parallelogram.

3 Bring out the similarity and differences between the trapezoid and the rectangle.

4 Use Exercises E to G to teach the triangle. Let the children try Exercises F and G on paper or the board.

5 Ask the children to write the words *rectangle*, *square*, *triangle*, *right angle*, and *parallel lines* on their papers and then to write under or opposite the correct word the letters that identify the figures.

240-241 Side trip

Expanded Notes are not considered necessary for this lesson.

Objectives

The child learns to use a simple scale in connection with a map.

Vocabulary

New words page 241 town*

Comments

The simple linear scale on page 240 is marked to represent the distance in miles between various places pictured on the map above. On most maps the scale is given by telling how many inches (or fractions of an inch) correspond to a certain number of miles on the map. On this map, though it is not shown in the picture, the scale is $\frac{5}{8}$ inch to the mile.

To help the children understand the idea of scale, have them make a plan of the schoolroom on the board, using a scale of one inch or $\frac{1}{2}$ inch to the foot. They can also make rough maps of their own neighborhoods, using a scale of one inch to the block. The abler children may be able to make a scale drawing of their living rooms, or bedrooms at home, etc. Be sure they take into consideration the size of the paper they are going to use before they decide whether $\frac{1}{4}$ inch, $\frac{1}{2}$ inch, or 1 inch will be equal to a foot. In making a scale drawing they should use their rulers only when they make the original scale on cards or stiff paper. Work with them until they see that any small distance they choose can stand for any number of miles or feet.

Ask the pupils to bring road maps to class, and let them practice measuring the distance between various points on these maps and then finding how far apart these places are by translating the scale into miles. The type of road map that has a small scale map of a large territory on one side and several large scale maps of cities or districts within that territory on the other side can be used very effectively in a discussion of all the aspects of scale and map reading that have been brought out so far. It will help the children understand

why some maps are large scale and some small scale, and will show them very clearly that maps of the same region can be drawn to many different scales.

Each child should have a strip of cardboard or paper that he can use to measure distances on the map against the scale as shown in Pictures A and B.

Answers

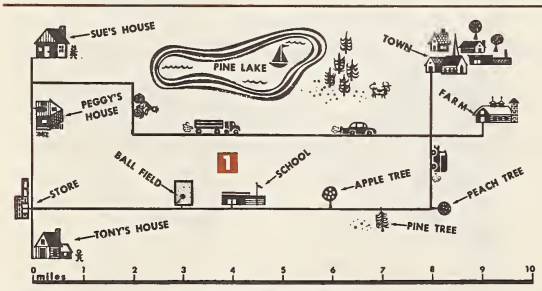
Side trip:

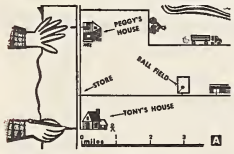
A 10 miles B 3 miles C 4 miles D $3\frac{1}{2}$ miles
E 1 mile F Twice as far
G 5 miles. Because there are two distances to be measured.
H The apple tree. The apple tree. Because you know the number of miles you want to measure and need to find the places on the map that are exactly that number of miles apart.
I 1 mile J 1 mile K Almost 3 miles
L Almost 7 miles M 5 miles N 7 miles
O 9 miles P 3 miles Q 8 miles
R Almost 7 miles S 3 miles T 4 miles
U 4 miles V 8 miles W Almost 8 miles

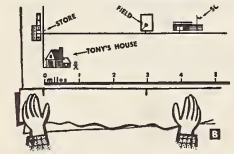
Keeping skillful:

(block 1)	(block 2)	(block 3)
A 36	A 597	A 21
B 9	B 6032	B 17 and 4 rm.
C 24	C 1100	C 23 and 1 rm.
D 500	D 42	D 26
E 32	E 438	E 11
F 9	F 2802	F 64 and 6 rm.
G 18	G 17 and 2 rm.	(block 4)
H 16	H 209	A 39 and 2 rm.
I 192	I 150	B 17 and 14 rm.
J 50	J 42	C 43
K 5	K 239	D 68 and 15 rm.
L 28	L 6305	E 38 and 3 rm.

Side trip







A Tony's father made this picture map to show the neighborhood. Below the map he put a scale to show distances. How many miles does the scale show?

B Now look at Picture A. Tony is marking on a piece of paper the distance from his house to Peggy's house. In Picture B he is putting his marked piece of paper on the scale on the map to see how far apart the houses are. They are how many miles apart? 2

C Use a piece of paper and the scale on the map to see how far Tony's house is from Sue's house.

240 Introduction to the use of a scale with a map

240

1 Let the children discuss the map and note the various places on it. Get them to speak of the roads in terms of parallel lines and right angles. Direct attention to the scale and explain that the distance between 0 and 1 represents a mile on the map.

2 Help the children discover how to use a strip of cardboard or the edge of a sheet of paper to measure distances on the map in the way that Tony is doing in Pictures A and B. Discuss with them whether it is better to put the paper on the map, mark the distance between two points on it, and then measure that distance on the scale or to put the paper on the scale first and mark a certain distance on it and then put the paper on the map to find two points that are just that distance apart. They should decide that sometimes they would do it one way and sometimes another. If any child thinks of duplicating the entire scale and using it as a ruler, let him.

D About how long is Pine Lake?

E About how far apart are the school and the ball field?

F The distance from the school to the store is about how many times as far as the distance from Peggy's house to the store?

G How far would you have to go by road to go from Peggy's house to the ball field? Why should you put 2 marks on your measuring paper?

H Which of the three trees is about 3 mi. from the ball field? Which tree is about 2 mi. from the school? Why should you mark your measuring paper from the scale before you answer these questions?

Now use a piece of paper and the scale on the map to find about how far apart these places in the neighborhood are.

2

I Tony's house and the store
J Sue's house and Peggy's house
K The farm and the peach tree
L The town and the school
M Tony's house and the school
N Sue's house and the school
O Sue's house and the apple tree
P The store and the ball field
Q Peggy's house and the apple tree
R The farm and the school
S Sue's house and the store
T Tony's house and the ball field
U The pine tree and the ball field
V The peach tree and the store
W The ball field and the town

Keeping skillful

A 3 ft. = ■ in.
B 72 pt. = ■ gal. 3
C 3 c. = ■ fl. oz.
D 2500 lb. = 1 T. ■ lb.
E 4 pk. = ■ qt.
F 36 pk. = ■ bu.
G 9 fl. oz. = ■ tbs.
H 68 wk. = 1 yr. ■ wk.
I 12 lb. = ■ oz.
J 1810 yd. = 1 mi. ■ yd.
K 10 c. = ■ pt.
L 7 bu. = ■ pk.

3

A 45 + 162 + 390 = ■
B 58 × 104 = ■
C ■ − 803 = 297
D 168 ÷ 4 = ■
E ■ + 562 = 1000
F 3001 − 199 = ■
G 87 ÷ 5 = ■
H 494 − ■ = 285
I 83 + 17 + 50 = ■
J 460 + ■ = 502
K 730 − 491 = ■
L 65 × 97 = ■

3

A 63 ÷ ■ = 3
B 89 ÷ 5 = ■
C 162 ÷ 7 = ■
D 156 ÷ ■ = 6
E 99 ÷ ■ = 9
F 518 ÷ 8 = ■

4

A 821 ÷ 21 = ■
B 932 ÷ 54 = ■
C 1161 ÷ 27 = ■
D 5047 ÷ 74 = ■
E 1257 ÷ 33 = ■

241

241

1 Let the children answer and discuss Exercises D to H as a class activity.

2 The children may work independently on Exercises I to W. After they have written their answers, let them verify their work and measure again any distances that they did not measure correctly at first.

3 Have the children write the answers to these sets of exercises in the usual way. Provide answers so that they can check their work.

4 Do not use this block of exercises unless the children have been taught division by two-figure numbers.

242-243 Using arithmetic

Expanded Notes are not considered necessary for this lesson.

Objectives

The child practices solving problems.

Vocabulary

New words page 242 conductor, kitchen*

Answers

Using arithmetic:

A 2×$9.13=[$18.26]
B 2×$5.05=[$10.10]
C $10.10−$9.13=[$.97]
D [$4.55]+$3.65=$8.20
E [851]+183=1034
F $1.90÷5¢=[38]
G $1.25+$1.41=[$2.66] or $1.41+$1.25=[$2.66]
H $1.41−$1.25=[$.16]
I 83−65=[18]
J 65+[79]=144
K 14÷7=[2]
L 27+[24]=51
M 468÷[52]=9
N [675]−468=207
O 12+9=[21] or 9+12=[21]
P [37]−21=16
Q $15.00−[$12.14]=$2.86
R 4×60=[240]
S $1.28÷[$.16]=8
T 21÷7=[3]

Keeping skillful:

	(block 1)	(block 2)	(block 3)
A	1140	584	14
B	16	22	17 and 5 rm.
C	80	1381	67
D	350	1862	51 and 2 rm.
E	1614	6849	81 and 1 rm.
F	14	21	49
G	5	110	87
H	7	80 and 2 rm.	(block 4)
I	10	2879	34
J	7	166	54 and 21 rm.
K	9	40	63 and 9 rm.
L	6	324	81 and 15 rm.
M	56	7050	65
N	25	399	20 and 17 rm.
O	10	201	62

Using arithmetic 1

A During the summer Bill and Tom took a train trip to Los Angeles. Round-trip tickets to Los Angeles and back home cost $9.13 each. How much did the 2 round-trip tickets cost?

B If the boys had bought one-way tickets, each ticket would have cost $5.05. How much would 2 one-way tickets to Los Angeles and back have cost one of the boys?

C One round-trip ticket cost how much less than 2 one-way tickets?

D To earn some money for the trip, Tom helped in his father's store for two weeks. He earned some money the first week, and he earned $3.65 the second week. In all he earned $8.20. How much did he earn the first week?

E The conductor on the train told the boys that the train would have gone 1034 miles by the time it got to Los Angeles. The boys were going only 183 miles. How far had the train gone before the boys got on?

F A man had some newspapers to sell on the train. He sold each newspaper for 5¢. In all he sold $1.90 worth of newspapers. How many newspapers had he sold?

G The boys ate lunch on the train. Bill's lunch cost $1.25. Tom's lunch cost $1.41. How much in all did the boys spend for lunch?

H Tom's lunch cost how much more than Bill's lunch?

I Each of the boys had a new book to read on the train. Bill read 83 pages in his book, and Tom read 65 pages in his book. Tom read how many fewer pages than Bill?

J Tom's book had 144 pages in it. How many pages did he still have to read to finish the book?

K The conductor told the boys that the train kitchen was about 14 ft. long and 7 ft. wide. The kitchen was about how many times as long as it was wide?

L The boys counted the people in their car. There were 27 people. Then more people got on. Later, the boys counted the people again. There were 51 people in the car. How many more people had got on?

M The conductor told the boys that there were 468 people on the train, and there were 9 cars on the train. What was the average number of people per car?

N The conductor gave each person on the train a yellow ticket that showed how far he was going. After he had given a ticket to everyone, he had 207 tickets left. How many tickets did he have at first?

O Bill and Tom bought a bag of small chocolate candy bars on the train. Bill ate 12 of the small candy bars, and Tom ate 9. How many of the candy bars did the two boys eat?

P Bill counted the rest of the candy bars and found that there were 16 left. How many candy bars were there to begin with?

Q Tom had $15.00 to spend for his ticket and for things on the train. When he got to Los Angeles, he had $2.86 left. How much had he spent on the trip?

R The train ride to Los Angeles took 4 hours. How many minutes was this?

S In Los Angeles Bill bought a package of 8 stamps for his collection. He paid $1.28 for the package of stamps. What was the average cost per stamp?

T The boys had 21 days to spend in Los Angeles. How many weeks was this? 1

Keeping skillful

2

A 6420 ft. = 1 mi. ■ ft.
B 64 qt. = ■ gal.
C 20 bu. = ■ pk.
D 715 da. = 1 yr. ■ da.
E 3614 lb. = 1 T. ■ lb.
F 7 fl. oz. = ■ tbs.
G 40 fl. oz. = ■ c.
H 56 qt. = ■ pk.
I 20 pt. = ■ qt.
J 43 in. = 1 yd. ■ in.
K 63 da. = ■ wk.
L 18 mo. = 1 yr. ■ mo.
M 7 c. = ■ fl. oz.
N 50 tbs. = ■ fl. oz.
O 40 pk. = ■ bu.

2

A 150 + 44 + 390 = ■
B 176 ÷ ■ = 8
C ■ − 560 = 821
D 38 × 49 = ■
E 7003 − 154 = ■
F 91 + ■ = 112
G ■ + 290 = 400
H 562 ÷ 7 = ■
I 5030 − ■ = 2151
J 65 + 88 + 13 = ■
K 320 ÷ ■ = 8
L ■ + 206 = 530
M 75 × 94 = ■
N 417 − ■ = 18
O 417 + ■ = 618

2

A 56 ÷ ■ = 4
B 158 ÷ 9 = ■
C 134 ÷ ■ = 2
D 206 ÷ 4 = ■
E 487 ÷ 6 = ■
F 245 ÷ ■ = 5
G 783 ÷ 9 = ■

3

A 918 ÷ 27 = ■
B 2667 ÷ 49 = ■
C 765 ÷ 12 = ■
D 3255 ÷ 40 = ■
E 2210 ÷ 34 = ■
F 1897 ÷ 94 = ■
G 3596 ÷ 58 = ■

242

1 Ask the children to work Problems A to T (N to T are on page 243). Direct them first to write the equation with the screen for the unknown number, then compute, and rewrite the equation with the answer in place of the screen. Have them label the problems with the identifying letters used in the book.

243

1 Let the children verify their work on Problems A to T (A to M are on page 242) by comparing it with equations and answers provided by you. Be sure that each child can explain the numbers and signs in the equations he used. Discuss thoroughly any problems that caused trouble.

2 You may use all of the exercises or select those that will give the children the type of practice they need most. Be sure to provide answers so that the children can verify their work. Discuss any exercises that caused trouble.

3 These should be used only with pupils who have studied division by two-figure numbers.

244-248 Looking back

Exponded Notes are not considered necessary for this lesson.

Objectives

The child reviews concepts necessary for understanding the number system, money, measurement, fractions and mixed numbers, and the four arithmetical processes.

Vocabulary

There are no new words.

Comments

In this review lesson, it is important for each child to have adequate opportunity to respond to each set of exercises. The children's work should be closely examined so that you can determine individual weaknesses and discover in what areas reteaching may be necessary.

Reteaching chart

The pages listed in the chart below indicate the pages in the pupils' book that can be used for reteaching.

Page 244:

Block	Pages
1	11-15
2	11-15, 126-128, 167
3	11-15, 126-128, 167

Page 245:

Block	Pages
1	70-73
2	76-78
3	76-78
4	195-197

Page 246:

Block	Pages
1	6-7, 8-9
2	10, 109, 230-231, 232-233
3	10, 91, 109, 230-231, 232-233
4	10, 91, 109, 230-231, 232-233

Page 247:

Block	Pages
1	208-211, 216-219
2	216-219
3	208-211, 216-219
4	212-215

Page 248:

Block 1 Exercises	Pages
A-F	182-191
G-I	20-23
J-L	32-35
M-Q	161-164

Block 2 Exercise	Pages
A	52-53
B	66-67
C	120-123
D	28-29
E	42-43

Answers

Page 244:

(block 1)

A	[C, B, G, E]	D	[A, B]	G	[D, H]	J	[A, B, E]
B	[C, H]	E	[B, G, H]	H	[A, G, E]	K	[C, F, H]
C	[D, G, E]	F	[A, G]	I	[D, F, H]	L	[A, F, E]

(block 3)

A	1,200,000	D	12,682	G	18,931	J	7,100,689
B	30,604	E	3,014,901	H	4,000,007	K	120,914
C	120,279	F	600,516	I	500,022	L	100,001

Page 245:

(block 1)

A	9	C	3	E	2	G	4	I	5
B	10	D	5	F	3	H	5	J	5

(block 4)

A $\$1.17 \div [\$.39] = 3$

B $\$.50 \div \$.09 = [5]$; $\$.05$ left over

C $\$1.70 \div [\$.34] = 5$

D $\$1.60 \div [\$.32] = 5$

E $\$4.00 \div [\$.80] = 5$

Page 246:

(block 1)

A 10° below 0; B 24° above 0; C More than 1 lb.; 8 oz. more; D No. The scales will only weigh up to 2 lb. E Yes. Each ounce is marked on the scale.

(block 2)

A	1	F	2000	K	1	P	12	U	12
B	7	G	8	L	60	Q	60	V	2
C	8	H	32	M	36	R	2	W	24
D	4	I	4	N	8	S	16	X	2
E	60	J	5280	O	3	T	52		

(block 3)

A	32	G	20	M	8
B	9	H	5	N	144
C	32	I	4	O	7
D	56	J	10	P	7
E	3	K	6	Q	48
F	28	L	180	R	12

(block 4)

A	50	G	45		
B	59	H	8		
C	6	I	34		
D	115				
E	730				
F	1000				

Page 247:

(block 1)

A [A] $\frac{2}{3}$; [B] $\frac{1}{4}$; [C] $\frac{2}{5}$; [D] $\frac{5}{8}$; [E] $\frac{7}{16}$; [F] $\frac{1}{2}$

B [G] $1\frac{3}{4}$, $\frac{7}{4}$; [H] $2\frac{1}{6}$, $\frac{13}{6}$; [I] $1\frac{1}{2}$, $\frac{3}{2}$; [J] $1\frac{4}{5}$, $\frac{9}{5}$; [K] $2\frac{3}{8}$, $\frac{19}{8}$

(block 3)

A	$1\frac{7}{8}$	C	$\frac{11}{5}$	E	$\frac{9}{12}$	G	$8\frac{1}{8}$
B	$7\frac{5}{6}$	D	$4\frac{9}{16}$	F	$6\frac{5}{9}$		

(block 4)

L $\frac{2}{4}$	N $\frac{3}{6}$	P $\frac{3}{12}$	R $\frac{2}{6}$
M $\frac{4}{8}$	O $\frac{2}{8}$	Q $\frac{4}{16}$	S $\frac{4}{12}$

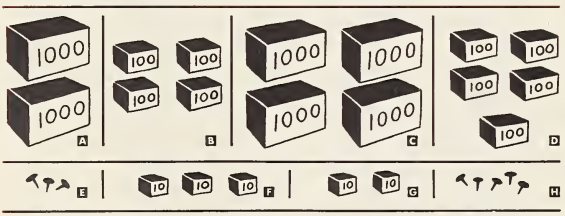
Page 248:

(block 1)

A 87	E 14	I 60 or 85	M 24	Q 1600
B 7	F 3	J 12	N 80	
C 70	G 145	K 32	O 320	
D 12	H 85 or 60	L 20	P 1920	

(block 2)

A Multiply B Divide C Divide D Add E Subtract



Looking back

What two or more pictures above would you use to make each of the numbers below?

1

A 4423	D 2400	G 505	J 2403	
B 4005	E 425	H 2023	K 4035	
C 523	F 2020	I 535	L 2033	

Read.

2

A 10,001	M 7,211,386		
B 8907	N 99,402,503		
C 7623	O 867,111,002		
D 877,350	P 6,400,689		
E 7658	Q 903,215,387		
F 95,000	R 100,003,011		
G 2009	S 862,340,190		
H 455,200	T 1,000,007		
I 8936	U 4,687,392		
J 789,142	V 1,283,999		
K 598,444	W 930,114,850		
L 77,380	X 5,002,316		

Write with numerals.

3

A one million two hundred thousand
B thirty thousand six hundred four
C one hundred twenty thousand two hundred seventy-nine
D twelve thousand six hundred eighty-two
E three million fourteen thousand nine hundred one
F six hundred thousand five hundred sixteen
G eighteen thousand nine hundred thirty-one
H four million seven
I five hundred thousand twenty-two
J seven million one hundred thousand six hundred eighty-nine
K one hundred twenty thousand nine hundred fourteen
L one hundred thousand one

4

244

1 Use these exercises for written work.
2 Have the children take turns giving the answers for these exercises. Be sure each pupil has a chance to respond at least once.
3 Have the children write out these exercises.
4 Refer to the Reteaching Chart for any reteaching you find necessary after you have gone over the work on this page.

Looking back

A 1 dollar = ■ dimes 10 pennies
B 1 half dollar = ■ nickels
C 1 quarter = 1 dime ■ nickels
D 1 half dollar = 1 quarter ■ nickels
E 1 dollar = ■ quarters 10 nickels
F 1 half dollar = ■ dimes 4 nickels
G 1 dollar = 8 dimes ■ nickels
H 1 dollar = 2 quarters ■ dimes
I 1 quarter = 2 dimes ■ pennies
J 1 half dollar = ■ dimes

For each problem below, draw the coins and bills that you would use in making change. Under each coin and bill write the number you would say as you make the change.

A Tony bought a model engine for $1.89. He gave the clerk $2.

B Mr. Block bought a calendar for $.69. He gave the clerk $1.

C Peggy bought a dog collar for $2.35. She gave the clerk $5.

D Mrs. Block bought some potatoes for $.53. She gave the clerk $1.

E Mrs. White bought a jar of honey for $.67. She gave the clerk $.75.

F Mrs. Sharp bought some paper napkins for $.26. She gave the clerk $1.

G Mr. Sharp bought a clock for $3.74. He gave the clerk $10.

1 Each problem below tells you what a clerk said when he made change. For each problem draw the coins and bills he gave in change. Remember that the first amount is always the cost of the thing he sold.

A 64¢, 65, 75, $1
B $1.34, 1 thirty-five, 1 forty, 1 fifty, $2
C $2.85, 2 ninety-five, 3, 4, $5
D $7.50, 7 seventy-five, 8, 9, $10
E 59¢, 60, 70, 75, 85, 95, $1
F $2.20, 2 twenty-five, 2 fifty, 3, 4, $5

2 A David spent $1.17 for 3 books. Each book cost the same amount. How much did each book cost?

B Some small flags that June wants to buy cost $.09 each. How many can she buy for $.50? How much money will she have left over?

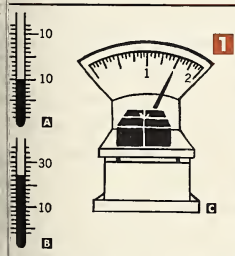
C In 5 days Bill spent $1.70 for meals at school. He spent an average of how many cents per day?

D Five boys earned $1.60 raking leaves. They shared the money equally. How much was each boy's share?

E Peggy spent $4 for 5 presents. She spent the same amount for each one. How much did each present cost?

3

Looking back



1 A Thermometer A shows what temperature?

B Thermometer B shows what temperature?

C Does the package on the scales in Picture C weigh more than or less than 1 lb.? How much more or less than 1 lb. does it weigh?

D Will the scales in Picture C weigh a 2 lb. 1 oz. package? Why or why not?

E Do you think you could weigh a 2 oz. letter on these scales? Why or why not?

2

A 12 in. = ■ ft.
B 1 wk. = ■ da.
C 1 pk. = ■ qt.
D ■ pk. = 1 bu.
E ■ sec. = 1 min.
F 1 T. = ■ lb.
G 1 c. = ■ fl. oz.
H 1 bu. = ■ qt.
I ■ qt. = 1 gal.
J 1 mi. = ■ ft.
K 365 da. = ■ yr.
L 1 hr. = ■ min.
M ■ in. = 1 yd.
N 1 gal. = ■ pt.
O 1 yd. = ■ ft.
P ■ mo. = 1 yr.
Q 1 hr. = ■ min.
R ■ pt. = 1 qt.
S ■ oz. = 1 lb.
T ■ wk. = 1 yr.
U 1 doz. = ■ things
V ■ c. = 1 pt.
W 1 da. = ■ hr.
X ■ tbs. = 1 fl. oz.

2

A 4 gal. = ■ pt.
B 18 c. = ■ pt.
C 4 pk. = ■ qt.
D 8 wk. = ■ da.
E 24 pt. = ■ gal.
F ■ pt. = 14 qt.
G ■ pk. = 5 bu.
H ■ c. = 40 fl. oz.
I ■ gal. = 16 qt.
J 5 pt. = ■ c.
K 12 tbs. = ■ fl. oz.
L ■ min. = 3 hr.
M 64 qt. = ■ pk.
N 4 yd. = ■ in.
O 21 ft. = ■ yd.
P 28 qt. = ■ gal.
Q ■ mo. = 4 yr.
R ■ tbs. = 6 fl. oz.
A 1810 yd. = 1 mi. ■ yd.
B 119 sec. = 1 min. ■ sec.
C 38 qt. = 1 bu. ■ qt.
D 480 da. = 1 yr. ■ da.
E 6010 ft. = 1 mi. ■ ft.
F 3000 lb. = 1 T. ■ lb.
G 105 min. = 1 hr. ■ min.
H 20 in. = 1 ft. ■ in.
I 70 in. = 1 yd. ■ in.

2

3

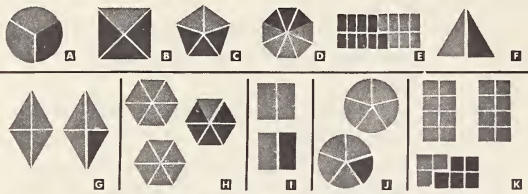
245

1 Have the children work independently on the exercises in this block. The work should be written.
2 The children should write the equation for each problem.
3 After pupils have checked their answers for these exercises, refer to the Reteaching Chart if you feel that any reteaching is required.

246

1 Use these exercises for oral work. Let the children discuss each question thoroughly, and let them answer as fully as they wish.
2 The children should write the answers for each of these exercises opposite its identifying letter on their papers.
3 Again, use the pages in the pupils' book that are listed in the Reteaching Chart for any reteaching that you feel is necessary.

Looking back



1 A For each piece of paper shown in Pictures A to F above, write the numeral that tells what part of the piece of paper is red.

B Look at Pictures G to K. Then write two numerals for the red part of each set of pictures. For Picture G you can write $1\frac{3}{4}$ and $\frac{7}{4}$.

2 Read.

A $1\frac{3}{10}$ D $\frac{15}{8}$ G $4\frac{1}{2}$ J $1\frac{4}{5}$
B $\frac{1}{5}$ E $2\frac{1}{6}$ H $\frac{7}{8}$ K $3\frac{3}{8}$
C $3\frac{1}{3}$ F $\frac{9}{16}$ I $1\frac{3}{6}$ L $6\frac{15}{16}$

3 Write with numerals.

A one and seven eighths
B seven and five sixths
C eleven fifths
D four and nine sixteenths
E nine twelfths
F six and five ninths
G eight and one eighth

Use one of the pictures below to answer each example below. Use Picture L for Example L, and so on.

L $\frac{1}{2}=\frac{?}{4}$ N $\frac{1}{2}=\frac{?}{?}$ P $\frac{1}{4}=\frac{?}{?}$ R $\frac{1}{3}=\frac{?}{?}$
M $\frac{1}{2}=\frac{?}{?}$ O $\frac{1}{4}=\frac{?}{?}$ Q $\frac{1}{4}=\frac{?}{?}$ S $\frac{1}{3}=\frac{?}{?}$

Looking back

A
$$\begin{array}{r|l} 7\overline{)87} & 10 \\ 70 & \\ \hline 17 & 2 \\ 14 & \\ \hline \blacksquare & \blacksquare \end{array}$$

1 A Number in all is ■.
B Number in each group is ■.
C Number in 10 groups is ■.
D Total number of groups is ■.
E Number in 2 groups is ■.
F Number left over is ■.

B
$$\begin{array}{r} 85 \\ 60 \\ \hline 145 \end{array}$$

1 G Number in all is ■.
H Number in one group is ■.
I Number in the other group is ■.

C
$$\begin{array}{r} 32 \\ 12 \\ \hline 20 \end{array}$$

1 J Number in the group being taken away is ■.
K Number in the whole group is ■.
L Number left is ■.

D
$$\begin{array}{r} 80 \\ 24 \\ \hline 320 \\ 1600 \\ \hline \blacksquare \end{array}$$

1 M Number of groups is ■.
N Number in each group is ■.
O Number in 4 groups is ■.
P Number in all is ■.
Q Number in 20 groups is ■.

2 A When you know the number of equal groups and the size of each equal group, how do you find the total number?

B When you know the number in all and the size of each equal group, how do you find the number of equal groups?

C When you know the number in all and the number of equal groups, how do you find the size of each equal group?

D When you know the number in one group and the number in another group, how do you find the total number?

E When you know the number in all and the number being taken away, how do you find the number left?

3

247

1 Have the children write out the answers to Exercises A and B.
2 Use these exercises orally.
3 The children should write the answers for these exercises opposite the identifying letters on their papers.
4 Use the pages listed in the Reteaching Chart for any necessary reteaching.

248

1 Have the children respond orally to these exercises. Discuss the examples thoroughly, and be sure the children understand the point of the questions asked about each example. The questions are aimed at determining whether children really understand the process in the abstract.
2 Use these exercises for oral response. These questions should summarize for the children the generalizations that are involved in working verbal problems and the thinking used in determining what arithmetical process should be used in solving specific problems.
3 Again, refer to the Reteaching Chart for any reteaching you think is necessary.

249-251 Checking up

Exponded Notes are not considered necessary for this lesson.

Objectives

The child tests his ability to solve all types of problem situations and equations presented in this book. He also tests his knowledge of the multiplication and division basic facts that were new in this book and his ability to compute, using all four processes.

Vocabulary

There are no new words.

Comments

These 14 tests are to be used diagnostically to determine the child's ability to understand and solve problems, to work with the four processes, and to interpret and solve equations. They are not speed tests, and only as many of them as the group can reasonably be expected to complete should be used in one class period. It is best to give the tests one at a time, and to follow each by any discussion and reteaching that may be necessary.

Finding out whether or not the child gets the correct answers is not the only goal. Much can be learned about the child's proficiency by noting his work habits and the procedures he uses to get his answers. Of particular significance are speed and assurance, signs of frustration and hesitation, counting on fingers or tallying, erasures that show faulty knowledge of the basic facts or a change of mind about the procedure, or evidence that the work has been done several times. All of these things should be taken into account in evaluating the results of these tests, and appropriate remedial work should be planned.

Reteaching chart

The pages listed below tell you where to turn for reteaching materials if you need them.

Test 1

Problem	Pages	Problem	Pages
A	120-123	G	66-67
B	52-53	H	86-87
C	134-137	I	170-173
D	130-133	J	28-29
E	42-43	K	88-90
F	86-87	L	92-94

Test 2

Problem	Pages	Problem	Pages
A	52-53	G	134-137
B	86-87	H	120-123
C	130-133	I	170-173
D	66-67	J	42-43
E	92-94	K	28-29
F	88-90	L	86-87

Test	Pages	Test	Pages
3	102-104, 110-113	6	32-35, 36-41, 45, 54
4	105-107, 114-117	7	147-153
5	18-19, 20-23, 24-27	8	161-164, 167
		9	182-191, 192

Test 10

Exercise	Pages
A	92-94, 45
B	24-27
C	88-90, 36-41
D	24-27
E	88-90, 36-41
F	92-94, 45
G	88-90, 45
H	24-27
I	92-94, 36-41
J	88-90, 36-41

Test 11

Exercise	Pages
A	45
B	134-137, 24-27
C	36-41
D	130-133, 36-41
E	134-137, 24-27
F	130-133, 45
G	45
H	134-137, 24-27
I	130-133, 36-41
J	45

Test 12

Exercise	Pages
A	182-191
B	120-123, 182-191
C	182-191
D	182-191
E	120-123, 182-191
F	120-123, 182-191
G	182-191
H	120-123, 182-191
I	120-123, 182-191

Test 13

Exercise	Pages
A	130-133, 45
B	161-164, 167
C	24-27
D	182-191
E	92-94, 36-41
F	134-137, 24-27
G	120-123, 182-191
H	45, 54
I	88-90, 45

Test 14

Pages 200-205

Answers

Test 1

A $56 \div [14] = 4$

B $30 \times 12¢ = [\$3.60]$

C $[49] - 14 = 35$

D $60 - [16] = 44$

E $123 - 48 = [75]$

F $25 - 18 = [7]$

G $56 \div 8 = [7]$

H 6342−2876=[3466]
I 12÷6=[2]
J 18+33=[51] or
33+18=[51]
K $3.75+[$2.55]=$6.30
L [65]+25=90

Test 2
A 3×59¢=[$1.77]
B 125−69=[56]
C 140−[122]=18
D 75÷5=[15]
E [59]+23=82
F 25+[7]=32
G [$6.30]−$3.85=$2.45
H $2.97÷[$.99]=3
I 28÷7=[4]
J 380−197=[183]
K 16+15=[31] or
15+16=[31]
L $8.00−$6.89=[$1.11]

Test 5	Test 6	Test 7	Test 8
A 836	A 1228	A 3160	A 27,720
B 109	B 232	B 912	B 3364
C 1928	C 707	C 2940	C 4674
D 1007	D 52	D 1300	D 26,748
E 208	E 1678	E 708	E 19,652
F 1801	F 2883	F 6471	F 27,225
G 940	G 57	G 1100	G 63,832
H 1764	H 508	H 4240	H 50,400
I 278	I 1087	I 2925	I 31,185
	J 194	J 4383	J 8613

Test 9	Test 10	Test 11
A 75	A 350	A 7168
B 97 and 1 rm.	B 1181	B 901
C 30	C 137	C 50
D 63 and 2 rm.	D 1003	D 79
E 97 and 4 rm.	E 237	E 867
F 29	F 460	F 801
G 90	G 211	G 1410
H 67 and 1 rm.	H 1200	H 443
I 41	I 535	I 633
J 53	J 52	J 4189

Test 12	Test 13	Test 14
A 28 and 2 rm.	A 6562	A 47 and 36 rm.
B 17	B 18,424	B 42
C 77 and 2 rm.	C 566	C 56 and 7 rm.
D 91 and 1 rm.	D 74 and 2 rm.	D 35
E 78	E 389	E 59 and 11 rm.
F 12	F 263	F 80 and 64 rm.
G 80	G 89	G 74
H 72	H 2537	H 49 and 12 rm.
I 93	I 129	I 50 and 42 rm.

Checking up

1 Test 1

A When the fourth graders saw a movie, the 56 children were sitting in 4 rows of seats. The same number of children were in each row. How many were sitting in each row?

B Jim made a dog house. He paid 12¢ a foot for 30 ft. of boards. How much did he pay for the boards?

C Peggy said, "I had to throw 14 of my shells away because they were broken. I have 35 shells left." How many did she have to begin with?

D Nancy's mother baked 60 cookies. She used some of them for lunch. Then 44 cookies were left. How many cookies had she used for lunch?

E Tony had 123 baseball pictures. He gave 48 of them to Jack. How many baseball pictures did he have left?

F The height of the school flagpole is 18 ft. The height of a tree next to it is 25 ft. The tree is how much taller than the flagpole?

G The 56 fourth graders at the Lake School divided into teams of 8 each for races. There were how many teams?

H The population of one town is 6342. The population of another town is 2876. How much smaller is the population of the second town than that of the first town?

I Don drew pictures of moths and bees for his science notebook. He drew 12 pictures of moths and 6 pictures of bees. He drew how many times as many pictures of moths as of bees?

J At the Youngs' family picnic there were 18 grown-ups and 33 children. How many people were at the picnic?

K The model engine that Bill wanted to buy cost $6.30. He had only $3.75. How much more money did he need?

L Tom bought 25 new stamps. Then he had 90 stamps in all. How many did he have before he bought the new ones?

2

Test 2

3

A Mrs. White bought 3 bags of candy. Each bag cost 59¢. How much did all three bags of candy cost?

B The pond on the Cooks' farm is 125 ft. long and 69 ft. wide. It is how much longer than it is wide?

Now turn the page.

1 Ask the children to work the problems in Tes 1. Direct them to write the equation with th screen for the unknown number, compute, the rewrite the equation with the answer in plac of the screen. Have them label the problem with the identifying letters used in the book.

2 Provide a set of answers for the children to us in verifying their work. Any discussion or re teaching that is necessary should be done be fore going on to Test 2.

3 Use the same procedures given under Note above with Test 2 (Problems C to L in Test are on page 250).

C There were 140 bottles of milk in the school kitchen one morning. At the end of the day there were only 18 bottles. How many bottles of milk did the children drink that day?

D Sue had 75 pictures of birds for her science notebook. She could put 5 pictures on a page. How many pages did she need for the pictures?

E Ann picked up 23 shells on the beach one day. Then she had 82 shells in her collection. How many shells did she have to begin with?

F Ellen had 25 records. She got some more for her birthday. Then she had 32 records. How many records did she get for her birthday?

G Jane spent $3.85 of the money she had in her bank for a present for her mother's birthday. Then she had $2.45 left in her bank. How much money was in her bank before she bought the present?

H Tom, Jack, and Bob shared the cost of a baseball and bat equally. The ball and bat together cost $2.97. How much was each boy's share of the cost?

I The Walls took 7 peanut butter and 28 chicken sandwiches to a picnic. They took how many times as many chicken sandwiches as peanut butter sandwiches to the picnic?

J At the Lake School there were 380 children. 197 of the children were boys, and the rest were girls. How many girls were at the Lake School?

K The fourth graders had 16 addition examples and 15 subtraction examples to work. In all, they had how many addition and subtraction examples to work?

L The Youngs looked for a new clock. One clock they saw cost $8.00. Another one cost $6.89. The second clock cost how much less than the first clock?

1

Test 3

A $5 \times 8 =$ ■
B $9 \times 9 =$ ■
C $9 \times 6 =$ ■
D $6 \times 7 =$ ■
E $8 \times 8 =$ ■
F $9 \times 8 =$ ■

2

G $7 \times 7 =$ ■
H $5 \times 9 =$ ■
I $7 \times 6 =$ ■
J $9 \times 7 =$ ■
K $7 \times 8 =$ ■
L $6 \times 9 =$ ■

Test 4

A $40 \div 8 =$ ■
B $72 \div 9 =$ ■
C $54 \div 6 =$ ■
D $81 \div 9 =$ ■
E $56 \div 8 =$ ■
F $45 \div 5 =$ ■

2

G $42 \div 7 =$ ■
H $63 \div 9 =$ ■
I $64 \div 8 =$ ■
J $54 \div 9 =$ ■
K $56 \div 7 =$ ■
L $42 \div 6 =$ ■

Test 5
Find the sum.

A 365, 442, 29
B 26, 17, 19, 47
C 796, 482, 650
D 134, 56, 817
E 72, 89, 12, 35
F 820, 563, 418
G 44, 824, 72
H 652, 794, 318
I 75, 94, 86, 23

Test 6

A $6060 - 4832 =$ ■
B $519 - 287 =$ ■
C $2113 - 1406 =$ ■
D $100 - 48 =$ ■
E $7321 - 5643 =$ ■
F $4000 - 1117 =$ ■
G $932 - 875 =$ ■
H $1246 - 738 =$ ■
I $8071 - 6984 =$ ■
J $530 - 336 =$ ■

Test 7

A $5 \times 632 =$ ■
B $8 \times 114 =$ ■
C $7 \times 420 =$ ■
D $4 \times 325 =$ ■
E $6 \times 118 =$ ■
F $719 \times 9 =$ ■
G $550 \times 2 =$ ■
H $848 \times 5 =$ ■
I $975 \times 3 =$ ■
J $487 \times 9 =$ ■

Test 8

A $84 \times 330 =$ ■
B $29 \times 116 =$ ■
C $57 \times 82 =$ ■
D $36 \times 743 =$ ■
E $68 \times 289 =$ ■
F $605 \times 45 =$ ■
G $808 \times 79 =$ ■
H $560 \times 90 =$ ■
I $495 \times 63 =$ ■
J $99 \times 87 =$ ■

Test 9

A $225 \div 3 =$ ■
B $486 \div 5 =$ ■
C $60 \div 2 =$ ■
D $569 \div 9 =$ ■
E $780 \div 8 =$ ■
F $116 \div 4 =$ ■
G $630 \div 7 =$ ■
H $403 \div 6 =$ ■
I $369 \div 9 =$ ■
J $424 \div 8 =$ ■

Test 10

A ■ + 650 = 1000
B 884 + 297 = ■
C 265 + ■ = 402
D 917 + 86 = ■
E 634 + ■ = 871
F ■ + 900 = 1360
G 891 + ■ = 1102
H 595 + 605 = ■
I ■ + 388 = 923
J 748 + ■ = 800

Test 11

A $8600 - 1432 =$ ■
B ■ $- 270 = 631$
C $934 - 884 =$ ■
D $673 -$ ■ $= 594$
E ■ $- 589 = 278$
F $1001 -$ ■ $= 200$
G $4368 - 2958 =$ ■
H ■ $- 354 = 89$
I $680 -$ ■ $= 47$
J $5147 - 958 =$ ■

Test 12

A $86 \div 3 =$ ■
B $119 \div$ ■ $= 7$
C $464 \div 6 =$ ■
D $820 \div 9 =$ ■
E $390 \div$ ■ $= 5$
F $72 \div$ ■ $= 6$
G $320 \div 4 =$ ■
H $216 \div$ ■ $= 3$
I $837 \div$ ■ $= 9$

Test 13

A $7001 -$ ■ $= 439$
B $49 \times 376 =$ ■
C $65 + 107 + 394 =$ ■
D $594 \div 8 =$ ■
E ■ $+ 311 = 700$
F ■ $- 65 = 198$
G $623 \div$ ■ $= 7$
H $3000 - 463 =$ ■
I $874 +$ ■ $= 1003$

Test 14

2

A $3232 \div 68 =$ ■
B $798 \div 19 =$ ■
C $1519 \div 27 =$ ■
D $1610 \div 46 =$ ■
E $719 \div 12 =$ ■
F $6384 \div 79 =$ ■
G $1332 \div 18 =$ ■
H $1629 \div 33 =$ ■
I $2342 \div 46 =$ ■

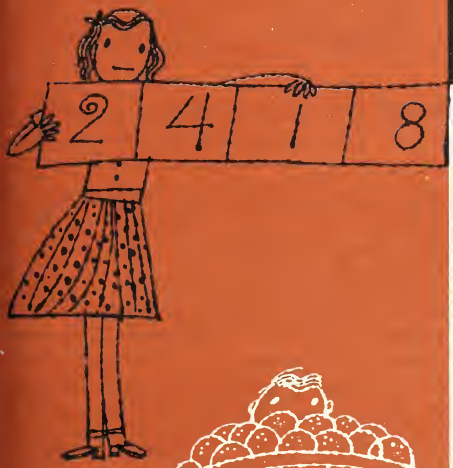
250

1 Have pupils finish this set of problems and verify their answers according to procedures suggested for the preceding page.
2 Use this test either orally or as written work. Do any reteaching necessary before going on.

251

1 Direct the pupils to write the numbers in computational form and compute. Be sure to evaluate the work on each test and do any reteaching necessary before going on to the next test.
2 Test 14 is to be used only with groups who have learned to divide by a two-figure divisor.

Your notes



10

This section of the *Teaching Guide* contains detailed suggestions for teaching the lessons. The Expanded Notes are really enriched lesson plans that go beyond the minimal essentials described in the Lesson Briefs (pages 15-225). Before using these Expanded Notes, read the comments and examine the reproduced pages and keyed notes in the Lesson Briefs section. For your convenience, page references are made to the Lesson Briefs at the beginning of each set of notes in this section.

Expanded notes

The Expanded Notes for each lesson include:

Overview

A very brief survey of the lesson as it is developed from page to page in the pupil's book

Teaching the whole class

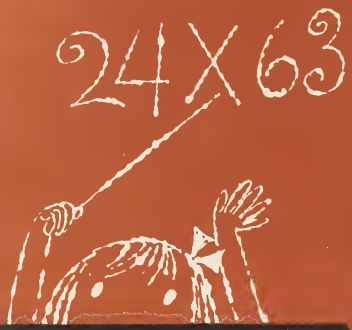
A plan of procedure to be used for the class as a whole before the children are separated into ability groups

Providing for the able pupil

Special suggestions for activities to extend the ideas of the lesson for abler students

Helping the slow learner

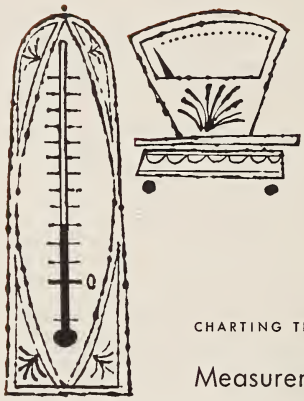
Suggestions to use in making clear the ideas of the lesson and for motivating interest therein



Expanded notes

A survey tour

of theory and method as applied to the arithmetic content of this course is provided in the Charting the Course sections included in the Expanded Notes.



CHARTING THE COURSE

Measurement

Arithmetic in the middle grades deals with number con cepts and skills needed daily by both children an adults as they meet quantitative situations in the activities. Among the situations in which the need f knowledge of arithmetic is most clearly evident a those involving measurement.

In beginning the work of a new school year, chi dren will be better prepared to learn if they are ab to see how arithmetic is useful to them. They can se this easily and concretely in measurement situation There is no immediate need for them to review th basic facts and computational processes learned in pr vious grades; to begin with these topics would tend emphasize the formal and abstract aspects of arithmet that are unappealing to some children. A study measurement, however, enables the teacher to emph size the uses of arithmetic in the practical activities home and school. For this reason *Seeing Throug Arithmetic 4* begins with a block of work on the mea urement of length, weight, and temperature.

The child should not only become aware of the e tent to which he may use measurement ideas, but h should also learn some of the elementary principl involved. In particular, he must learn that a *unit*

measure is necessary and that a *standard unit* is usually used. He should learn what a scale is, how the marks on a scale represent units of measure, and how scales are used in measuring.

Ordinary "rulers" are one common kind of scale. Scales for measuring weight and scales for measuring temperature (thermometers) are also common. In the case of the Fahrenheit thermometer, perhaps the hardest thing for the child to understand is the arbitrary association of 32 degrees with the temperature at which water freezes. The zero point of this scale is merely a point 32 degrees lower than the one at which water freezes, and it is not a "real" zero point or point at which temperature "begins." It is not essential that children gain a clear understanding of this situation in Grade 4. They should, however, be able to read a thermometer and become aware that this involves the use of numbers.

Pages 3-10 of *Seeing Through Arithmetic 4* provide a basis for learning experiences of the sort described above. They also provide for a review of some common standard units and of relations between units such as the foot and the inch.

3-5 Moving forward

Lesson Briefs for this lesson are on pages 16-19.

Overview

The work on these pages is planned to give the children some basic understandings about measurement. The need for standard units, the use of different scales for measuring different things, and good measuring techniques and habits are among the things considered. On page 3 the various kinds of measuring instruments used to measure length, time, weight, temperature, etc., are introduced. An opportunity is provided to compare different kinds of scales. Pages 4 and 5 focus attention on the 12-inch ruler. Children are shown some of the ways in which rulers are marked, as well as correct and incorrect ways of using them in measuring.

The measuring instruments pictured are all within the experiences of the child, and discussion of these instruments can be centered around their everyday uses.

Teaching the whole class

Children need not only discussion of measuring instruments, but also experiences in measuring—for they learn to measure only by measuring. They need many experiences in seeing, handling, and using all kinds of measuring instruments. In teaching this lesson, therefore, you will want to have on hand as many examples of the measuring instruments shown on pages 3-5 as you can.

For the work with the foot ruler, outlined on pages 4 and 5, you will need foot rulers that are marked in different ways, so that the children will be alerted to the differences and the possible pitfalls in using these instruments. Each child should have his own ruler, preferably one that is not calibrated to smaller fractions than ⅛ inch, preferably ¼ inch. At this time the child will be measuring only to the nearest inch. Children who do not have rulers or who have commercial ones with a great many subdivisions of the inch can make plastic rulers. (See Activity 1, page 330.) As the lesson proceeds, objects for the children to measure should be provided.

You will not find any time limit set for this lesson or for those that follow. However, you should not attempt to cover all the work on these pages in one class period. Let the needs of your pupils govern the length of time devoted to this lesson. Spend enough time so that pupils will feel comfortable and will have time to assimilate the ideas before they are asked to go on to something new. On page 359 you will find an approximate time schedule for the work in this book.

Present the new words in this lesson just as you would in a reading lesson—that is, write the words on the chalkboard, pronounce them, discuss them, and use them meaningfully in oral situations before you ask the children to read them. Notice that, to lighten the reading load for the children, complicated directions for the work are not given in the child's book. It is the teacher's responsibility to give such directions.

As you well know, any classroom contains individuals who differ in capacity for achievement. Some pupils need many concrete experiences to master arithmetical ideas. Abler pupils quickly tire of such activities. They need, instead, more challenging—usually more abstract—activities to keep them interested. The notes for this block of work and for those that follow are arranged accordingly.

This section, "Teaching the whole class," tells you what to do in working with the group as a whole. "Providing for the able pupil" and "Helping the slow learner" give activity suggestions arranged according to the needs of the pupils. (For this block of work, you will find these special sections on pages 232-233.) Be sure to look at these suggestions *before* you begin teaching the lesson. For those pupils with the most serious deficiencies in arithmetic, you will need to provide work for a time at the third-

grade level. Copies of *Seeing Through Arithmetic 3** of this series will be very helpful for such work.

Page 3: Note the statement beside the heading "Moving forward." It has been put there because the authors feel that it is important for children to have some idea of what they are going to learn in the first block of work. A similar statement is included for each succeeding block of work that introduces a new idea or ideas. These statements should always be read and discussed in class before the new work is taken up.

One way to begin this lesson on measuring is to call the children's attention to some of their own experiences in measuring. You might start the lesson by saying:

I wonder if you have ever thought about all the measuring we do. For instance, many of you are taller now than you were when school closed last year. Do you know how tall you are? How do you find out how tall you are?

Let the children discuss their heights, how much they have grown since school closed, and how their heights are measured. Ask them if they know what a yardstick is and if they have seen a weighing scale with a measuring rod on it. Then continue as follows:

How many of you gained weight during the summer? How much do you weigh now? How do you find out how much you weigh?

By asking questions get the children to tell about experiences they have had with measuring instruments in general. Lead them to talk about some of the kinds of instruments shown on page 3, and then have them open their books to this page and look at the pictures.

The pictures should be used as topics for further discussion and to find out what the children know about each of the instruments and their uses. They serve, too, to set the stage for a more thorough study on the pages that follow. Wherever possible, you will want to supplement the picture study and discussion with actual experiences in seeing and handling some of the instruments shown.

Ask pupils if they know what the instruments shown in Picture A are. Help them identify the object at the top as a foot ruler. Point out that it is not in full size and that the numerals are missing. Tell pupils that they will study the foot ruler more completely in their work with the next page. Pupils should be able to identify the next object as a yardstick because of the three parts, each equal to the foot ruler shown above. If pupils cannot identify the tape measure, tell them what it is. Have examples of these three objects in the room, and call on pupils to identify them.

To focus attention on the need for standard units, say:

You remember, of course, that when we were talking about your heights we used the words feet *and* inches. *Do you think the inch on the measuring instrument each of you used was the same length? Are all the inches of different measuring instruments the same? Why do you think they have to be the same?*

Bring out in the discussion that people would be unable to compare the lengths of objects or talk about measurements unless they knew that the same measuring units were being used by everyone. Explain that once the size of a measuring unit has been agreed upon and given a name, such as *inch* or *foot*, it becomes a *standard unit* and it is always supposed to be the same size.

The clocks shown in Pictures B and F offer an opportunity for discussing the measurement of time. Of course, most fourth-graders can tell time, but questions similar to those below will review the relationships between the units of time. Say, for example:

In Picture B point to the hour hand. Point to the minute hand. How is it different from the hour hand? Point to the second hand. How is it different? How many seconds are in a minute? When the minute hand has moved from 1 to 2, how many minutes have gone by? Then what time will it be? How many times will the second hand go completely around the clock while the minute hand moves from five minutes past five to ten minutes past five? How many minutes are in an hour? While the hour hand moves from 5 to 6, how many times does the minute hand move around the clock?

Discuss briefly how we use the twelve hours on the clock to show the 24 hours in the day. Have on hand an old clock or a cardboard play clock that has movable hands, so that the children can see the relative movements of the second, minute, and hour hands. As an activity, let the children take turns setting the clock to a time and telling what they would be doing at that time. The other members of the group can then read the time and tell whether it was A.M. or P.M. Encourage the use of expressions for telling time that are common to the locality. These might include: five minutes *to* seven, ten minutes *of*

**Seeing Through Arithmetic 3* by Maurice L. Hartung, Henry Van Engen, Lois Knowles, and Catharine Mahoney. Third-grade book in The Basic Mathematics Program. Scott, Foresman and Company.

six, fifteen minutes *before* twelve, quarter *to* nine, quarter *past* eleven, quarter *after* eight, *half past* ten, etc.

You will not need to spend much time on Pictures C and D. Let pupils tell what things each of the scales in Picture C might be used to weigh. Let them describe other weighing instruments and what they might be used to weigh. Then tell the class that they will study scales more thoroughly a little later.

Ask pupils what the two types of thermometers in Picture E are used to measure and make sure they understand that they cannot be interchanged in usage. Explain that they will learn more about these thermometers a little later.

Finally, call attention to the measuring dials that are found in cars (Picture F). Let children tell, if they can, what each dial is used to measure. Call attention to the fact that some of the dials have numerals on them and others have letters. Discuss briefly what the letters and numerals stand for. Explain to the children that each of these dials is based on a different scale—that different units are used to measure the different things.

You might ask the children to be on the lookout for pictures of the measuring instruments. Ask them to bring them to the class, so that they can be mounted on the bulletin board.

Page 4: The general procedure for working with this page is to have the children read the questions and refer to the appropriate pictures to get the answers. The pictures will be much more meaningful if you use a ruler to demonstrate each of the situations.

First ask the children what measuring instrument and what measuring unit is being used on this page. When they tell you that the instrument is a ruler and have discovered that the inch is the measuring unit being used, ask them to show you how long they think one inch actually is. Then let them compare their estimates with an inch on a real ruler or yardstick. Next call on a pupil to read Question A, which has to do with right and wrong ways of measuring a stick of wood. Have children look at the first stick in Picture A and the ruler beneath it. Ask:

Is the ruler placed at the left end of the stick? Now look at the second stick and the ruler beneath it. Is the ruler placed at the left end of this stick? Point to the part not being measured. Which ruler and stick show the right way to measure the length?

In connection with Question C, you might ask the children if they think the second stick in Picture A is also 10 inches long and why they think so.

Before taking up Questions D to F, have the pupils look at Picture B. Have them note the beginning point on the ruler and the absence of a numeral for this mark. They should decide that the numeral 0 could be placed at this mark. Point out that the left end of this ruler is rounded and that it does not look as if there is a full inch between the end and the first mark. Therefore, they cannot use the left end of the ruler as the beginning point. Then ask pupils to look at the rulers in Picture A. Ask why they can begin measuring at the left end of these rulers.

In connection with Question E, pupils should see that even though the ruler in Picture B is actually longer than 12 inches, only the 12 inches that are marked are to be used in measuring. Ask them to note where the numerals are placed on this ruler. Then ask them to look again at Picture A to see where the numerals on the ruler are placed. Be sure pupils understand that it is the space between two marks that is the inch and not just the mark or numeral itself. Give pupils opportunities to look at various foot rulers to compare the differences in markings. Let them show on each one the point at which they would begin to measure. Pass the different kinds of rulers around so that the children will all have a chance to compare them.

When considering the measuring situation in Picture D, pupils should decide that it would be impossible to measure the card in inches, since there are no inch markings on the foot ruler. They might guess, however, that the card measures about a half foot. You could ask the children if they can think of a way to measure the card in Picture D. If no one suggests it, explain that they could mark the length of the card on a piece of paper; then they could measure the space between the markings with Ruler C. Let someone carry out this suggestion.

Page 5: The questions on this page are a continuation of those begun on page 4, and the same general teaching procedures should be followed. When the children begin to do some actual measuring, you should be alert to their difficulties. Help them to coördinate properly. Watch for carelessness, clumsiness, and the common mistakes discussed on this and the preceding page.

In talking about the scale on the ruler in Picture E, be sure the children realize that it goes to 12 inches, although the numerals only go to 11. Remind them that other kinds of measuring instruments also have different kinds of scales, as, for instance, the ones on page 3.

Pupils should determine that the stick in Picture E is not being measured in the usual way because the

edge of the stick is not at the left edge of the ruler. You might ask some of the abler pupils how the length of this stick can be determined, using the facts shown in Picture E. They should see that because the stick is measured against the ruler starting at 2 inches instead of at 0 inches, they should subtract the 2 unused inches from 10 inches to get the length of 8 inches.

Question N may cause the children some difficulty. If so, tell them that when the marks at the ends of a ruler or worn or damaged, it can be used as suggested in Picture E. If you have some worn or damaged rulers, you might cover the ends with adhesive tape to prevent the marks from showing and thus demonstrate to the class how such rulers can be used to measure objects.

Pupils should observe that the stick in Picture F is not placed properly. It is not parallel to the edge of the ruler, and the end of the stick is not exactly at the end of the ruler.

Finally, ask pupils to read Question Q. They should observe that the two rulers are not placed close together, and that because of this some of the table is not being measured.

Have the pupils summarize what they have learned about the correct way to use a foot ruler in measuring objects.

Conclude the lesson by letting the children spend as much time as they need to measure with foot rulers any objects found in the room. Be sure they see the differences that occur when the objects are not placed parallel to the ruler or at the beginning measuring point of the ruler.

If each child does not have a 12-inch ruler with each inch plainly marked, suggest that the children make rulers. See Activity 1, page 330. The abler pupils might help the slower ones in this activity.

When each child has a ruler, ask the children to hold the rulers up with the numerals facing you. Then ask them to indicate 5 inches, 10 inches, etc. Check the children's work each time you give them a new length to find. Then ask them to measure objects on their desks (such as pencils, papers, crayons, books, etc.) and tell them to be ready to tell the class what the lengths or widths are and prove them by demonstrations with the rulers. If the lengths come to fractions of an inch, it would be best to let pupils say, "My book is not quite 8 inches long," or, "My crayon is a little over 3 inches long."

Then let them take turns estimating the lengths of small objects (not over 12 inches in length) that can be found around the room. Give them opportunities to check their estimates with the results of actual measurements. While these measuring experiments are going on, you will want to observe the children to find out which ones do not yet understand how to measure with a ruler. Such children will benefit from the activity suggestions found under the heading "Helping the slow learner."

Be sure to conclude the work by having someone read aloud the statement beside the flag on page 5.

Providing for the able pupil

The abler pupils should enjoy doing independent reading on measurement. Such reading will be of more value if you provide specific questions for which they are to find the answers. The pupils should then be asked to make reports to the rest of the class on what has been found. Suggested questions that can be answered by reading pages 19-22 of the book *How Much and How Many,* by Jeanne Bendick, are: "How were the inch, foot, and yard decided upon as standard measuring units?" and "Are these measuring units the same all over the world?" See Activity 2, page 331, for further information about this book.

Helping the slow learner

By observing the actual measuring experiences of the pupils in connection with this lesson, you will have noted the pupils who do not have a clear idea of what is involved in measuring. For these pupils you will want to provide additional activities that are designed to develop the most fundamental measuring ideas. To help these pupils realize that we all must use the same measuring unit to make any comparisons or verifications in measuring situations, try the following activity.

Have available two sticks or narrow pieces of oaktag of different lengths, one about 6 inches long, the other about 12 inches long. These sticks or pieces of cardboard should not have any measuring marks on them. Give the longer stick to one of the pupils and ask him to compare the length of his arithmetic book with this stick. Give the 6-inch stick to another child and have him compare his stick with a textbook that is more than 6 inches long. Then call on each pupil to tell what he found out about the length of his book and the stick he is using. Of course, the pupil measuring the arithmetic book will report that his book is shorter than the 12-inch stick; the other pupil will report that his book is longer than the 6-inch stick.

Ask the children if they can tell from these reports which book is longer. Point out that although it sounds as if the last book measured is longer, they cannot be sure unless they see the measuring sticks and watch the measuring. Get them to decide what is

needed so that the two children who did the measuring can talk about their measuring experiences and compare results. From this experiment it should be apparent to the group that for different people to compare the lengths of books or of anything else, they must use either the same stick or identical sticks as measuring instruments.

To show pupils that there is a more accurate way of measuring things than by comparison with the length of a stick or piece of oaktag, have someone find the length of the arithmetic book by counting the number of equal-sized measuring units it takes to cover the distance to be measured. One pupil may demonstrate to the whole group, or each pupil may do this on his own. At least 12 one-inch sticks or one-inch square pieces of oaktag will be needed for each participant. Do not tell the children that these are one-inch sticks, however, but point out that they are equal in size. Ask the pupils to place the sticks or pieces of oaktag in a straight line, ends touching, from the top edge of the book to the bottom edge. It will be found that 9 sticks or pieces of tagboard are needed. If it turns out that the measurement is a little more or less than 9 sticks, let the children say that the book measures "9 sticks and a little over" or "not quite 9 sticks."

To show still another way of measuring this book, tell a pupil to place it flat on a piece of 8½″ x 11″ paper and draw along the backbone edge, making a line on the paper to represent the length of the book. Then ask him to take just one of the one-inch measuring sticks used before and place it on the line, starting at the top. Tell him to make a pencil mark at the end of the stick, then pick up the stick and place it down again, this time starting at the mark just made. Have him continue this activity until the end of the line is reached. Then have him count the marks to see how many times he used the one-inch stick to measure the length of the line. Tell him that since the line represents the length of his book, he now knows the length of the book, which should be about 9 sticks. If this experiment is too difficult for the slow learners, you may demonstrate it yourself.

The following activity may be used to teach the meaning of *inch*. If all the pupils in the group are participating, see that each one has a ruler. Then tell a pupil (or pupils) to place one of the one-inch measuring sticks or pieces of oaktag at the beginning point of the ruler. Point out that the stick ends at the numeral 1 on the ruler and that this means the stick is 1 inch long. Point out, too, that since they already know that each stick is the same length, they now know that each stick is 1 inch long. Next ask them how long two sticks together should be. Then ask the pupil (or pupils) to put another stick down, starting at the 1-inch mark on the ruler, and to note that it ends at the numeral 2. Have this activity repeated until all 12 of the sticks are used and the entire length of the ruler is shown with sticks. The last stick should end at the numeral 12 on the ruler or as close to it as possible. You may point out, if you wish, that 12 inches equal 1 foot. This, among other previously taught equivalents, is reviewed on page 10.

Remind pupils that they have found in two measuring activities that their arithmetic book is 9 sticks (and a little over or a little less) long. Ask them how many inches this is. After the answer of 9 inches has been obtained, let a pupil check it by using a ruler to measure the book. At this time you may again discuss the good habits and techniques of measuring taught on pages 4 and 5. Then give the slow learners a list of things to measure, asking them to write beside the names of the objects what they find the lengths to be. You may check their work at your convenience.

6-7 Moving forward

Lesson Briefs for this lesson ore on poges 19-20.

Overview

The purpose of these two pages is to show pupils how weight is measured. On page 6 pupils learn from pictures and questions that the weight scale is based on pounds. They learn that, for accurate measurement, the indicator on the scales must point to the zero mark before the object to be weighed is placed on the scales. To give children an understanding of standard units, page 7 shows how to calibrate scales for weighing.

Teaching the whole class

Children will learn the basic weighing ideas more quickly and more easily if they have scales to use and objects to weigh. In advance, then, try to collect a few types of weighing scales. You can probably get scales that are used to weigh children at school, bathroom scales, and postage scales. Ask for the children's help in getting any other types of weighing scales that may be available.

Page 6: As with the preceding lesson, the questions provide a starting point for discussing the pictures. You might begin by asking the children to look over the pictures on page 6 to see what is going to be studied next. Let someone read the "Moving forward" statement.

After the children have considered Picture A to find out if anything is being weighed, they should be able to give two reasons for knowing that nothing is being weighed—the bag is not on the platform of the weighing scales, and the pointer is at zero.

In working with Picture B, stress the fact that the unit of measurement on these scales is the pound. You may ask one of the abler pupils what he thinks the marks between the numerals show (half pounds). Then call on other children to state how much the bananas would weigh if the pointer were at 1, at 5, at 3, at 4. Remind the children that the ounce is a smaller weight unit than the pound. Ask a pupil to tell how many ounces equal one pound. (This equivalent and others will be reviewed on page 10.)

When discussing Picture C, ask questions similar to these:

Is anything being weighed in Picture C? How do you know? Do you know how much the package weighs? Why not?

Discuss the fact that the circular face of the dial does not mean that the marks on it should be like those on a clock. If you have weight scales with a circular dial and a clock with a circular dial, it would be a good idea to show the pupils the difference in the markings.

In calling attention to Picture D, tell pupils that the same scales are shown twice, first with nothing being weighed, and then with Tom weighing himself. Say:

Look closely at the picture of the scales on which nothing is being weighed. Is the pointer exactly at zero? When there is nothing on the scales, where should the pointer be? Do you think something is wrong with the scales? If the pointer is not exactly at zero before Tom gets on the scales, do you think Tom weighs exactly 85 pounds as the picture shows? Do you think he weighs more than or less than 85 pounds?

Do you remember when we were studying measuring with a ruler that we had to be careful to start measuring with the beginning mark on the ruler so that our measurement would be correct? Would you say that zero is the beginning mark on these weighing scales? If the pointer doesn't point exactly to zero when there is nothing on the scales, we should realize that the measurement will not be correct. Scales sometimes become inaccurate and need to be adjusted.

You might ask one of the abler students to explain how scales might be used even if they are inaccurate. You may have to hint that it can be done by subtracting from or adding to the total weight the discrepancy the scales shows when there is nothing on it.

If any of the children wonder about the dial for the scales in Picture D, tell them that it is on a wheel that turns inside the scales.

Conclude the work on this page by giving the children a chance to examine the various weighing instruments available in the room to note whether or not they are accurate.

Page 7: Begin by asking pupils to read Question H. Be sure they understand that the numeral 0 on the dial in Picture E is the beginning point of the measuring scale and that zero is placed there because that is where the pointer points when there is nothing on the scales. Remind the children that on the ruler the marks and numerals were also called a scale and the standard unit there was the *inch*. Tell them that on weight scales the unit of measurement is the *pound*.

Care has been taken in the book to use the word *scale* to indicate the marks and numerals with them that are found on any measuring instrument to show the number of standard units involved. The plural form *scales* is used to describe the weighing instrument.

In connection with Picture F, be sure the pupils realize that the bag of sugar weighs 1 pound. Tell them that when 1 pound of anything is put on the scales the pointer moves a certain distance. Make clear that, since the numbers are being placed where they belong, the place at which the pointer stops should be noted and a mark and the numeral 1 inserted at this point.

When pupils look at Picture G, they should note that another 1-pound bag of sugar has been placed on the scales and that the pointer has moved to another place. They should note that another mark has been placed on the scale. Let the pupils decide that the numeral 2 should be placed opposite it.

Let the pupils discuss Question K, suggesting ways for finishing the scale on the dial. You might let them estimate how many pounds might be indicated on the dial.

If you have scales similar to the ones pictured on pages 6 and 7, you can cover the calibrated dial with paper, leaving only the starting point visible. Then you can let the children place objects that they know weigh 1 pound each on the scales one at a time and make the pound marks and numerals on the paper in the proper places.

To conclude the lesson, ask the pupils to discuss Question L. Children who did not make rulers as suggested in the preceding lesson, may like to make rulers now. Let the children discuss various ways of

making a foot ruler. The best way, of course, should be based on a method similar to the way the marks and numerals were put on the scales discussed on this page; that is, an object that is known to be one inch long should be used in measuring off one-inch spaces on a board or a piece of oaktag. See Activity 1, page 330, for complete details.

Finally, the statement beside the flag should be read and discussed, and children should be given opportunities to show that they know how scales are used to measure weight. Let the children weigh things that weigh more than a pound. Tell them to give the measurements to the nearest pound. Let various children weigh the same things and compare the weights they find.

Providing for the able pupil

To help the children get a better understanding of weight measurement, have them do independent reading of the type suggested in Activity 2, page 331. Prepare questions like the following:

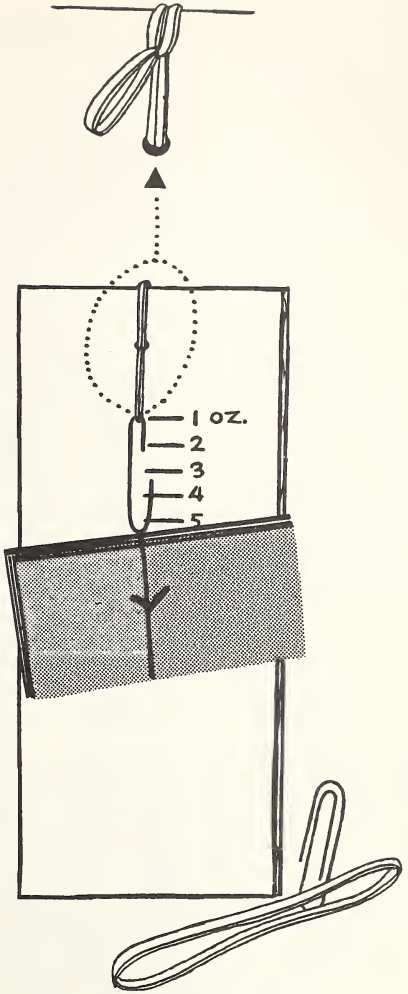
What was the first weighing machine like? How did people weigh things years ago? Why was this an unsatisfactory way?

Refer the children to pages 53-56 of *How Much and How Many* to find the answers.

In connection with the class work in calibrating the scales on page 7, you might suggest to some of the abler students that they make a simple weighing device with a scale in *ounces*. In advance, you should have a sample prepared so that the pupils can study it to help them in making similar ones (see picture in the next column). A rectangular piece of reinforced paper (about 12″ x 4″) such as that used in making cartons, a rubber band that stretches easily, and a medium-sized paper clip will be needed. Make a hole in the middle and near the top of the corrugated sheet. Then open the clip and straighten it except for the top bend (see illustration). Once straightened out, the bottom end may be rebent to form a hook on which to hang one-ounce objects.

To assemble the weighing instrument, the rubber band should be inserted in the hole and one loop slipped through the other. (The illustration shows an enlargement of how the rubber band is looped.) The bent paper clip should then be hooked onto the remaining loop. The weighing instrument is now ready for calibration.

Any object known to weigh 1 ounce may be placed on the hook of the paper clip. Then a mark should be made and labeled at the point to which the rubber band stretches with the object's weight. (The object may need to have a piece of string tied around it for hooking purposes.) To make the two-ounce



mark on the scale, either another one-ounce object should be attached to the first or something known to weigh 2 ounces should be placed on the hook. (If there are no one-ounce objects handy, 3″ x 5″ cards may be tied in bundles—about 15 weigh an ounce.) Let the children calibrate the scale as far as practical. (The number of ounces will be determined by the size and stretch of the rubber band that you use.) They may notice that the spaces between these ounce marks are not equal. If the children do not know the reason for this, you may have to explain that the farther the rubber band is stretched, the greater the tension is, and the rubber band stretches out more.

Encourage ingenuity and originality in making the scales. The important thing is the idea of calibration and the meaning of scale.

Helping the slow learner

The slow learner needs all the experiences he can get in weighing objects. After he has had a few opportunities to see objects weighed in class, he should be allowed to work independently. For such activity, be sure to have small scales available. The pupils can work in pairs. Have a variety of objects suitable for weighing. Lists of objects may be made on 4″ x 6″ cards, and each card identified by a letter. The cards may include such items as: paste jar, book, paint jar, box of crayons, workbook, pencil box, box of jacks, desk calendar, paint box. List several items on each card. Then give each pair of children a card and tell them to weigh the objects listed. Direct them to write on their papers the card letter and the list of objects in a column. As they weigh the objects, they should record the weights.

You can also let a group of children or a "weighing committee" find the weight of each member of the class to the nearest pound. They can make a chart showing the weight of each child.

8-9 Moving forward

Lesson Briefs for this lesson are on pages 21-22.

Teaching the whole class

Children will benefit greatly from work with real thermometers. To help them understand that there are different kinds of thermometers and that the scales on them vary, have on hand a collection of meat, candy, oven, weather, and clinical thermometers. If you plan to demonstrate to the class that the freezing point of water is 32 degrees, you will need a bowl of ice cubes. If you intend to give the children the experience of putting some of the calibration marks on a thermometer, you should remove the glass tube from a thermometer.

Page 8: Discussion for this page centers around Thermometer A. Thermometers B, C, and D are to be used mainly with the questions on page 9.

You can start the lesson by saying:

Today we are going to learn how to measure something we can feel but cannot see! What do you suppose that is?

Let the children guess what they are going to measure. Then have them turn to page 8 and read the statement after the heading "Moving forward." Call their attention to Thermometer A and proceed somewhat as follows:

Look at the tube in the middle of the thermometer. Does anyone know what liquid may be in the tube? Does the liquid always stay at the same level? Does it go up when the air gets warmer? What happens when the air gets colder?

Then, to call attention to the scale on the thermometer, ask:

Does the scale on this thermometer remind you of the scale on any other measuring instrument? What is the bottom numeral on this scale? What is the top numeral? Look at the bottom numeral on the other three thermometers on this page. Are they the same as the one on Thermometer A? Now look at the top numerals. Are they all the same? The scales on different thermometers do not always have to begin and end with the same numerals. We shall try to find out why different kinds of thermometers have different numerals on them.

Let pupils read the explanatory statements opposite Thermometer A. Then say:

The temperature is at 54 degrees on this thermometer. What is the first numeral you see above the mark showing 54 degrees? Does this mean 60 degrees? What is the next numeral? Read all the remaining numerals on the thermometer going upward. Read them as degrees. How many degrees are there between the numerals? How many degrees are there between the marks? Find 60 degrees again. Use your pencil and count by twos as you point to each of the marks from 60 degrees to 70 degrees.

Next ask a pupil how much the temperature would be on Thermometer A if the liquid moved up from the present 54 degrees to the next higher mark. Then ask how much it would be if the liquid moved down to the next lower mark. Also discuss the probable reason for having each space on the scale represent two degrees instead of one degree. (The marks would be too close to read easily unless we made a very large thermometer.)

Page 9: Thermometers B, C, and D on page 8 should be referred to in answering most of the questions on this page.

In connection with Question B, point out that the zero mark is not at the beginning of the scale as on rulers or weight scales. Ask the children to look at the first numeral above zero. Ask them to tell how many degrees this is. Then have them find the first numeral below zero. Let them tell how many degrees this is. Explain to the pupils that when they refer to a below zero temperature, they must indicate that it is *below* zero because we take for granted that above zero is meant if we do not say "below zero." Remind

them that in reading most thermometers the space between two marks indicates two degrees. Explain that the correct way to read the temperature for Thermometer C is to say "12 degrees below zero." Let the children answer Questions C to H by referring to the thermometers on page 8.

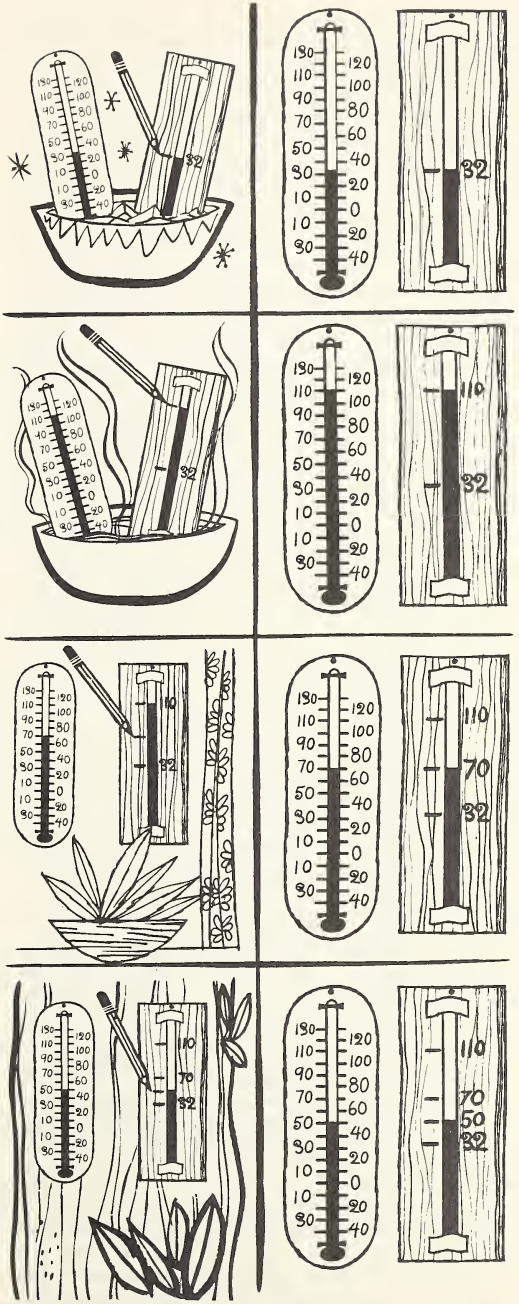
For Question I, discuss the normal air temperature range for your locality. Ask the children about what they think the temperature is on the hottest and coldest days of the year. Point out that in other localities it may be hotter or colder, and that the scale range on thermometers is made to fit various climates. Explain that this is one reason for the differences in the scales on the thermometers on page 8.

Help the pupils see that Thermometer E, referred to in Question J, could not be used to measure temperature because there are no numerals on it and there is no way of telling where zero is. Ask pupils if they could figure out where the other numerals should be if they knew where zero was.

Before going on to a discussion of Question K, tell the children that water freezes at 32 degrees above 0. Have them look at Picture F to see this illustrated. Then tell them that water boils at 212 degrees and call attention to Picture G. Tell the children that a thermometer used in cooking must have a scale that extends at least to the boiling point, but that the freezing point of water does not have to be included on such a thermometer. Ask pupils why the freezing point would be needed on an outdoor thermometer.

Next tell the children that you are going to have them put some of the markings and numerals on a thermometer with a blank tube similar to the one shown in Picture E. Remove the glass tube containing the fluid from a thermometer and tape the tube to a thin piece of wood. Put some ice that has started to melt in a bowl, and insert the unmarked tube. Let all the children watch the liquid in the tube drop. When it has become stationary, have the pupil place a mark on the wood opposite the point to which the liquid has dropped. Then, for verification, put in another thermometer. The liquid in this thermometer should drop to 32 degrees. The numeral 32 should then be written beside the mark on the wood.

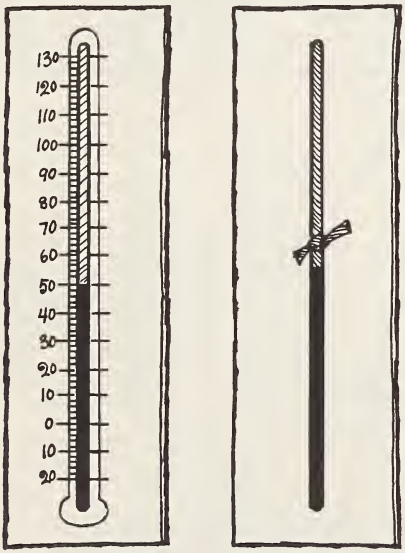
In the same way experiments should be performed with the two thermometers to find the temperature of warm water in a pan, the room temperature, and the temperature outdoors. From the four marks made on the piece of wood, children should get an idea of how to make a thermometer scale. The series of pictures at the right shows how the two thermometers can be used in the four experiments.



Calibrating a home-made thermometer

Providing for the able pupil

A committee of abler pupils may make a large thermometer in which the tube of liquid is represented by a movable string, one half of which is colored red. The children will need a piece of cardboard 5″ x 18″. They should draw the outline of a tube and copy the calibration marks and numerals from a thermometer. Have the scale range from approximately 20 degrees below zero to 130 degrees above. At both the top and the bottom of the part of the drawing representing the tube of liquid, holes should be made, so that a piece of string can be inserted. One of the children should color red one half of a piece of heavy white string about 32 inches long. The white end of the string should then be inserted through the top hole from the front, and the other end (the red end) should be inserted through the bottom hole from the front. The ends should be tied together at the back of the thermometer just tightly enough so that the string can be moved. See the picture below.



This thermometer may be placed on the bulletin board and used to show the temperature outside at specified times of the day.

Helping the slow learner

The slow learners may need more practice in reading temperatures. The string thermometer described above can be used for this.

These children may also participate in setting the temperature on the string thermometer, as described above in the activity for the abler pupils.

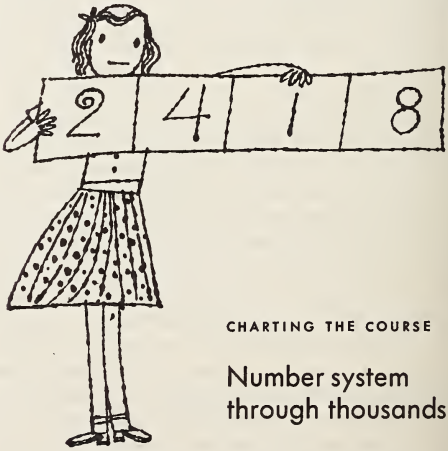
The slow learners could make a weather-report chart for the classroom. Each day they could bring in the name of the city or town in the United States that was the warmest and the one that was the coldest and enter it on a chart on the bulletin board. There should be a space for each day for the names of the cities or towns and their temperatures as shown below. If the children are interested they can continue the chart for a longer period.

Day	Warmest Place	Temperature	Coldest Place	Temperature
Monday	Miami	88°	Aberdeen	15°
Tuesday				
Wednesday				
Thursday				
Friday				

10 Keeping skillful

Lesson Briefs for this lesson are on pages 22-23.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Number system through thousands

To understand arithmetic, pupils must understand the number system. Two ideas—*grouping by tens* (10 ones, 10 hundreds, 10 thousands), and *place value*—are basic. Children learn the principles of the number system by seeing first how a large group of objects can be organized through grouping by tens. Second, they learn

how written records of such groupings can be made by using tallies or numerals and the idea of place value.

Pupils who have used *Seeing Through Arithmetic 3* should be well grounded in the basic principles of the number system. For pupils who have not had this program, and as a review for those who have, *Book 4* includes a presentation of the basic principles on pages 11 and 12. The number system is extended to include numbers up to 9999. The aim, however, is not to teach individual numbers. Instead, the *system* is to be taught so that the pupil can understand and deal with any number by using the principles of the system.

Special attention is given to methods of regrouping that are useful later in learning "carrying" in addition. Pupils are shown, for example, how 2 groups of one hundred objects and 14 groups of ten objects can be regrouped as 3 groups of one hundred and 4 tens, and hence the number is 340. Similarly, the principle underlying "borrowing" in subtraction is shown by taking apart a group of 100 objects and arranging it as 10 groups of ten. Thus a total group of 425 objects can be arranged as 3 hundreds, 12 tens, and 5 ones. This is a preliminary step in a subtraction from 425 if the number to be taken away has more than 2 tens—as, for example, 32. In short, pages 13 and 14 provide a review of the regrouping principles needed for an understanding of carrying and borrowing. Page 15 summarizes the work of the four preceding pages.

11-15 Looking back

Lesson Briefs for this lesson are on pages 23-26.

Overview

A number such as 1243 is commonly expressed as one thousand two hundred forty-three. Children should be able to read it in this way and understand it as 1 thousand, 2 hundreds, 4 tens, and 3 ones. They must also understand that we can think of this number in many other ways without changing its value. For example, 1243 may be thought of as 1 thousand, 2 hundreds, *3 tens*, and *13 ones*, or as 1 thousand, *1 hundred*, *14 tens*, and 3 ones, and so on. In reviewing these ideas, this lesson gives attention to grouping, place value, regrouping (as preparation for carrying and borrowing), and the reading and writing of numerals to 9999.

On page 11 children are retaught how quantities of objects to 9999 in number can be organized into groups of thousands, hundreds, tens, and ones, for purposes of easy counting. They are helped to recall that 10 single objects (ones) may be considered as one group of ten, that 10 tens may be thought of as a collection of 1 hundred, that 10 hundreds may be looked at as a collection of 1 thousand. They recall, too, how place value is used in writing the figures that stand for these groupings: that in a four-figure number, the figure at the farthest left position indicates how many thousands there are; the next position, the number of hundreds; the next, the number of tens; and the position at the right, the number of ones. They see that the same numeral can stand for ones, for tens, for hundreds, or for thousands, and that its written position shows what it stands for.

On page 12, the children count objects grouped in thousands, hundreds, tens, and ones, and place the figures representing the objects in their proper positions.

On page 13, as preparation for carrying in addition, children review what they know about how to regroup so that there are no more than 9 ones, 9 tens, or 9 hundreds in a group. They see that objects grouped as 2 hundreds 14 tens may be regrouped as 3 hundreds 4 tens (by rearranging the 14 tens into 1 hundred and 4 tens) and the entire rearrangement written as 340.

On page 14 children learn to "undo," or do the opposite of, what was done on page 13. They start with objects grouped as 4 hundreds 2 tens and 5 ones, and learn that they can regroup the objects as *3 hundreds 12 tens* and 5 ones or as 4 hundreds *1 ten* and *15 ones*. The knowledge that 1 hundred can be changed to 10 tens and 1 ten to 10 ones is basic to the idea of borrowing (regrouping) necessary in the process of subtraction.

On page 15 there are questions for discussion and problems for individual work. These help the child to find out how well he is able to read and write numbers from 1 to 9999 and how well he understands what he is writing.

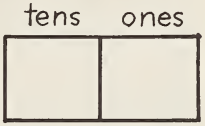
Teaching the whole class

In previous grades the children have undoubtedly used sticks, blocks, pieces of paper, and other objects for working with groups of tens, ones, etc. You may wish to continue using such materials as you "look back" with them on what they know about place value and regrouping.

If you plan to use objects, be sure to have a sufficient collection on hand ahead of time. The needs and interests of your group will determine the materials you select.

Before working with page 11, for example, you may wish to dramatize the meaning of two-place

numbers by having children group objects in tens and ones and write the symbolizations of these groups in the proper places. Suppose, then, that you gather together in a central place a collection of 43 pieces of chalk. Ask two children to put the pieces of chalk in groups of ten. Have rubber bands available so that they may band each of the groups. While they are doing this, write on the chalkboard the headings "tens" and "ones" and draw a rectangle under them and divide it in two sections so that there will be separate spaces to put the numerals representing the groups of tens and the single ones. The tally space should look like the one shown in the picture at the right. Then ask one of the children to count the number of groups of ten pieces of chalk. Have the class tell in which part of the tally space this numeral should be written, and let the child write it there. Then have the single pieces of chalk counted and that numeral written in the proper part of the tally space.



Point out that the numeral representing the tens was placed in the left part of the tally space and that the numeral representing the ones was placed in the right part. Then write the numeral 43 beneath the tally space in the usual way, read it, and ask pupils to explain what the 4 stands for and what the 3 stands for. Underneath the figure 43 write the figure 34. Ask the class if switching the numerals has changed anything. Let someone explain how the amount has changed by showing with the pieces of chalk what 34 means.

Page 11: As you work on page 11, focus attention first on the groups of objects in each picture, then on their written representations in the tally space. For example, in considering Picture A, say:

Do you see some pieces of butterscotch candy? As many as possible of them have been put in piles of ten. How many piles of ten do you see? How many single pieces of candy not in a pile of ten do you see? Now look at the green part of the picture. Do you see a tally space like the one we worked with at the board? On which side of the white line has the figure standing for the 7 groups of 10 candies been written? Where has the 5 that stands for the single pieces of candy been written? How many tens are there? How many ones are there? Read the numeral [75] under the green tally space. What does the 7 stand for? What does the 5 stand for?

Treat Picture B in much the same way, but call attention to the fact that there are no single pieces of candy and, therefore, no figure is written in the ones' section of the tally space. Have pupils note that the 4 tens are rewritten as 40, and that the zero means that there are no ones. As another activity with this picture say:

Suppose you ate 4 pieces of candy. Look at Picture B again and imagine how the candies that are left would look. Think to yourself how many boxes of ten there would be and how many single pieces of candy. Then on a piece of paper make a tally space with two sections and write the number of tens and ones there are. Next write these figures as a numeral underneath the tally space. Does everyone know how these figures would look written in words?

Let someone write the numeral on the board in words. Discuss it with the class, if necessary.

For Movie C, point out that there are two scenes with the same bundles of sticks in each. Ask pupils how many sticks are in each bundle in the first scene. Next let them discover how many bundles of ten there are and check this number with the figure written in the tens' section of the tally space. Then ask them if they remember what can be done when there are 10 tens. Suggest that they look at the second scene. Point out that another section for *hundreds* has been put at the left side of the tally space. Continue by relating the picture of the pile of 100 sticks to the tally space and the numerals and words beneath it.

In connection with Movie D, tell the children that sometimes there are labels on packages that indicate how many items they contain. Ask them to pretend that there are sheets of paper in these packages and have them tell how many sheets are in one package. Then ask if they can tell how many tens are in each of these packages. Refer children back to Movie C, if necessary. Continue the work with the pictures and the tally spaces in the two scenes, as you did with Movie C.

Picture E may be treated in the same way as Picture A.

To get the children to think about how numerals to 9999 are used in their everyday life, ask them to participate in the following activity. Ask each one to make a list of examples using any numbers that he has heard people make reference to or that he has seen in writing; for example, "There are 3425 people in the neighboring town," "Our car has traveled 9814 miles," etc.

Page 12: This page offers opportunities for both oral and written practice related to place value. Picture A may be discussed with the class. Then let the

children decide individually what figures belong in the tally spaces in Pictures B, C, and D. If necessary, let them write the figures on paper. Then have the children look again at the pictures as you have them answer Questions A to G as a result of group discussion.

Questions A to J in the second column should be used for written work. Afterward discuss the answers with the class. For Questions H, I, and J, the children will enjoy finding out if any of them have written the same numerals, who has written the largest number, and who has written the smallest number.

If some of the slower pupils seem to be having trouble, write several numerals on the board and for each number draw a line under the figure whose place you want identified. If necessary, let these children make tally spaces to help them decide what place the figure is in.

Page 13: Before working with this page, draw on the chalkboard a picture showing 2 boxes each labeled "1000," 3 boxes each labeled "100," 12 boxes each labeled "10," and 5 boxes each labeled "1." Then ask the children to determine how many thousands, hundreds, tens, and ones are shown by the picture. Ask for a volunteer to write this as a numeral on the board. This, of course, will bring up the problem of how to write numerals involving more than 9 in each place. Some of the children may suggest that the boxes be regrouped.

Tell pupils to open their books to page 13, where they will see what is involved in regrouping objects. Have them look at the first scene in Movie A and note the number of boxes of one hundred, the number of boxes of ten, and where the figures are written in the tally space. Ask the children what is happening in the next scene. [Ten of the boxes of ten have been put into a bigger box to make another hundred.] Have them look at the last scene to see the result of the regrouping and the change in the figures in the tally space. Ask someone to write "3 hundreds 4 tens" on the board in the regular way (as 340) and then read the number. If any of the slower children seem to be having trouble understanding this regrouping, let them use objects and work through the sequence in Movie A. Boxes labeled "100 pencils" and "10 pencils" may be used.)

Movie B should be taught in the same way. Tell children that the scene which shows the candies being grouped into more tens is now missing. This time there are enough extra ones to make *two* more groups of ten. In Movie C have children note that at first there are no groups of ten, but after regrouping they have 1 group of ten.

For Pictures D and E, have children look at the objects and supply the missing figure in the first exercise. After they have completed the first statement for a picture, the children should be able to get the missing numerals for the second statement. Or they may visualize the regrouping for each picture and get the missing numerals that way. The slower pupils should be allowed to use objects, if necessary, in working through the sequences of Pictures D and E.

Before Exercises A to I are discussed, have the children look again at the picture you drew on the board and tell how the boxes can be regrouped and a numeral written. Let someone draw the regrouped boxes and write the numeral. If possible, keep the drawings on the board so that they can be used in connection with page 14.

Page 14: Call attention to the rearranged groupings of boxes on the board that were used with the preceding page (2 boxes labeled "1000," 4 boxes labeled "100," 2 boxes labeled "10," and 5 boxes labeled "1"). Suggest to the children that now they are going to find out how to undo what they did with the boxes.

Tell them to turn to page 14, where they will find how to change a numeral like the one represented on the board into another form. Have them look at the objects in the first scene of Movie A and the tally space showing the numerals representing the objects. Ask pupils to tell what is happening in the second scene. They should see that one of the bundles of one hundred sticks (or ten bundles of ten) is being broken up and put with the other tens. For the third scene, have pupils relate the numerals in the tally space to the groups of objects. Help the pupils see that the numeral 425 has now become 3 hundreds 12 tens 5 ones.

Treat Movies B and C in the same way, but point out to pupils that the scene is now missing in which a larger group is broken up and put with other groups. You may ask pupils to describe what this missing scene would be like for each of these movies. The slower children should be allowed to use objects to work through the sequences in Pictures A to C.

For Pictures D and E, tell pupils to find the missing numerals for the first statement by referring to the pictures. When they know these numerals, they should be able to find the missing numerals for the second statement.

The answers to Exercises A to R should be written by the children. Help them make the observation that in their work on this page they have broken up larger groups into smaller groups, which is exactly the opposite of what they did on page 13.

Page 15: This page provides a summary of the preceding work.

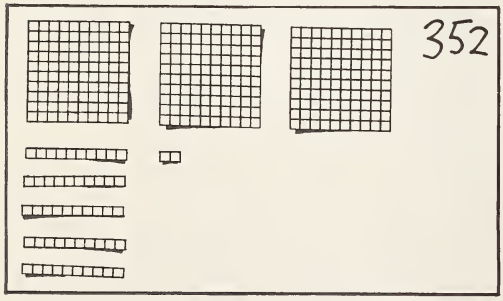
To help the children get the answers to the three questions in the first block, tell them to make tally spaces and write in them the numerals representing each of the Pictures A, B, and C. Instruct them to make a second tally space in which they rewrite the numerals to show the necessary regrouping of the objects. Finally, they should write the number in the regular way.

In using the second block (labeled "Read"), let the children take turns reading one of the rows of numbers.

Exercises A to H should be assigned as written work. Exercises A to K may be treated as either oral or written work.

Providing for the able pupil

Squared (graph) paper can be used for an activity on the meaning of numerals to 9999. You will need several sheets of graph paper about 17″ x 22″, with squares that measure at least one fourth inch. Give each of your abler pupils a number. Tell him that he is to cut out sections of the graph paper to represent his number. As he cuts out the sections of squares, he should write "100" on the sections of 100, "10" on the sections of 10, and "1" on the single squares. Direct him to paste all of the sections on a large sheet of colored construction paper. The number that the pupil is illustrating should be written in the upper right corner. Posters may then be displayed on the bulletin board. A sample poster illustrating the numeral 352 is shown below.

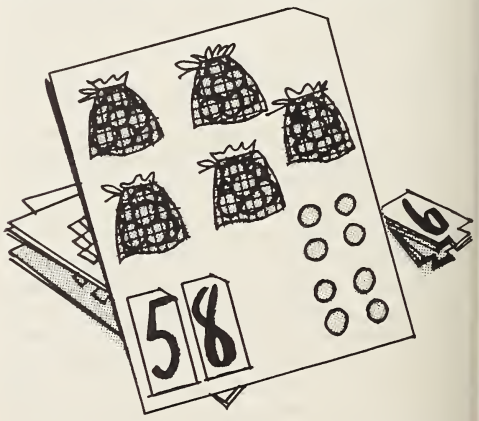


As an activity following work with page 14, have the abler pupils write in tally spaces other possible groupings for Movies A, B, and C and Pictures D and E. Remind them that the regroupings may contain more than 19 tens or ones. Although this activity is not necessarily preparation for simple borrowing situations (where only 1 ten, for example, is borrowed), it has possible value in suggesting some non-conventional regroupings that might be helpful in certain situations involving objects.

Helping the slow learner

As an activity to develop the meaning of numerals, prepare cards listing about five two-figure, three-figure, or four-figure numerals. Let a child select a card and illustrate each numeral using pictures of objects in ones, tens, hundreds, and thousands. Squares made of paper or cardboard, or boxes, may be used. They should be labeled "one," "ten," "hundred," and "thousand." Be sure the child understands how many tens are in each hundred and how many hundreds are in each thousand. After he has made the groupings for each numeral, he is to describe the groupings to either you or to another (preferably abler) child, and then say the number in its regular form.

Another activity of this type involves cards with three numerals indicated as "3 hundreds 12 tens 6 ones," etc. The child selects a card and draws pictures of objects (squares, circles, or boxes) to show the normal grouping of each number. When he has finished the regrouping, he should describe the groupings and say the number in its regular form.



To give the slower pupils more experiences in seeing the groupings involved in two-figure and three-figure numbers, the picture cards in the *Arithmetic Readiness Cards, Set 2: Number System** (see illustration above) may be used to advantage. Place

**Arithmetic Readiness Cards, Set 2: Number System,* by Maurice L. Hartung, Henry Van Engen, and Helen Palmer Scott, Foresman and Company. Set of 54 cards in full color with pictures on both sides illustrating the numbers 10 to 99 and eighteen three-figure numbers. Also included are tally mark cutouts and number symbols to insert in slots on the picture cards, and a Teacher's Guidebook with suggestions for use.

on a table a pile of picture cards, a pile of numeral cards, and a pile of tally cards. Instruct a pupil to take the first picture card and find the tally-mark cards that belong with the picture. Tell him to fasten these cutouts in the card. After he has done this correctly, the card may be placed on the chalk ledge so that the other children can see it. Let each child have one or two turns. After the tally marks have all been inserted and looked at, they may be removed, and the children may take turns inserting the correct numerals. The Teacher's Guidebook to *Arithmetic Readiness Cards, Set 2: Number System* suggests many other activities based on cards of this type.

A game called "Number Along" provides practice in regrouping (as preparation for carrying). See Activity 3, page 331, for complete details.

CHARTING THE COURSE

Addition process

Pupils in Grade 4 are supposed to know what addition means and are also supposed to know all the addition basic facts. Teachers have found, however, that they cannot rely on such knowledge. It is important to find out whether pupils know the meaning of addition and to check up on their ability to recall the addition basic facts. If the facts are not easily recalled or have not been learned, special remedial procedures should be used.

If a pupil does not know the work of a previous grade, ideally he should do his reviewing or relearning from the third-grade book. All such pupils will profit from the study of the original lessons in *Seeing Through Arithmetic 3* on basic facts. It is not possible to include in the pupil's book for any grade, materials adequate for reteaching all that he is supposed to have learned in previous grades. A pupil who has serious deficiencies cannot be expected to repair them by study of a condensed treatment in a book intended for pupils who have normal achievement.

A majority of the pupils, however, should need only a review—a review that aims at recall of understandings as well as skills. It should cover ground that seems familiar though some of the details have been forgotten. In *Book 4* the process of column addition with one-figure numbers, two-figure numbers, and three-figure numbers is retaught by exactly the same procedures as were used for the original presentations in Grade 3. The four-step teaching method is used without any shortening or condensation.

In general, *Seeing Through Arithmetic* follows the policy of providing for a thorough reteaching of a process in the grade immediately following the one in which it is introduced. Materials first taught two or more grades earlier are, however, not presented again except incidentally. For pupils who have not mastered a concept two years after the grade in which it is first presented, no ordinary treatment will suffice, and certainly a condensed treatment is not adequate. Pupils who are two or more years retarded in arithmetic clearly need more and different remedial help than can be included in any ordinary textbook for the grade level in which they are classified administratively. There is danger of confusing and discouraging such pupils by using review procedures suitable for the average pupil. On the other hand, average or even above-average pupils can benefit by a well-planned review. For them review and more practice lead to increased confidence and higher achievement.

In this book the numbers in computational exercises are always shown in horizontal (or equation) form. There are two reasons for this. First, when the pupil analyzes a problem, he should recognize the basic actions, actual or imagined, that occur in the problem situation. For example, in an additive situation there may be a group of 8 boys who are being joined by another group of 5 boys, and the problem is to tell how many boys will be in the resulting or total group. This situation may be described in symbols by writing $8+5=\square$. The horizontal, or equation, form shows most clearly and conveniently how the thinking process proceeds. Moreover, it corresponds to the horizontal writing and reading from left to right that is used with ordinary, or non-arithmetic, statements.

Second, the pupil should learn to put the work in the vertical (or computational) form for himself. In a genuine problem that he meets in life outside school, the numbers are not arranged for him. The computational form of arranging work has certain advantages when computation becomes complicated. In this book the pupil is shown how to arrange the work in computational form, too, but after it has been taught he is expected to *arrange the work for himself*. The knowledge of how to arrange the work and the habit of arranging it correctly are things he must learn. If examples are always arranged in computational form for the pupil, he too frequently fails to know what to do in genuine problem situations.

Another important feature of this book is that the first example of addition of two-figure numbers (on page 20) is one that requires carrying. Similarly, the first example of addition of three-figure numbers (on page 24) involves carrying. This is done in accordance with the following principle: The first example of a process should be as representative of the complete process as possible. (In this connection, read again the discussion of "Guiding Principles" in introductory pages 6-14 of this *Teaching Guide.)*

In *Seeing Through Arithmetic 4*, the pupil is given an opportunity to see *the situation as a whole* so that, once he understands it, he does not later have to make major readjustments in his thinking. In the case of addition, for example, he can understand why it is important to begin on the right with the "ones" if he begins with carrying. His normal reading habits would lead him to work from left to right, but in arithmetic he must often alter these and work from right to left. In examples of addition without carrying he can work either way without trouble. He cannot understand the reason for the rule "begin with the ones" until he has met an example that requires carrying and understands how to do it.

Once the pupil has learned how to work with a truly representative example, the special cases (such as addition without carrying) are relatively easy and require no special treatment. Thus the organization of the curriculum is simplified, and the number of major treatments necessary is reduced. Moreover, in making up examples of her own, in this organization the teacher does not need to be constantly on guard to be sure the example does not require carrying before carrying has been taught. Although the work on pages 20-29 calls for no more than the addition of three three-figure numbers, some pupils may be able to understand and do much more complex examples if they are given sufficient time. The principles have all been taught by page 29; and if they are understood, all that remains to be done is to provide practice for skill and to extend gradually the number and size of the addends.

16 Looking back

Lesson Briefs for this lesson are on page 27.

Expanded Notes are not considered necessary for this lesson.

17 Checking up

Lesson Briefs for this page are on page 28.

Overview

In *Seeing Through Arithmetic 4* there are 63 tests that may be used to inventory what has been studied and to measure achievement. These tests are arranged in groups under the heading "Checking up." The first set of tests is on page 17 of the child's book. Many of these tests are End-of-block tests that test the child's knowledge of topics just studied or abilities just acquired. This enables the children and the teacher to use such tests *diagnostically*. If a child cannot respond, or if he makes errors that are not just the occasional careless slips characteristic of child behavior, he needs more learning experience before going ahead with new work. Additional learning experiences should therefore be confined to things he does not know.

It is true that children have difficulty in reading or studying typical arithmetic texts, with the result that both teacher and pupils come to regard the textbook chiefly as a source of practice exercises. In preparing *Seeing Through Arithmetic 4*, much attention was given to making a book that children could read, study, and understand. The pictures closely relate the learning to concrete situations. The complete, yet simple, explanations are written in a carefully controlled vocabulary. The best material for any needed reteaching, therefore, is found on the pages where the explanation was originally given.

It should be a common experience for children to reëxamine materials they have studied earlier whenever the need arises. *Seeing Through Arithmetic* was designed with this purpose in mind.

Some of the tests in "Checking up" sections include mixed types of exercises (pages 124, 125, 180

181, 249-251). These tests are more appropriate for securing achievement scores than for diagnosis. The other tests are primarily diagnostic.

The tests on page 17 require knowledge of the addition basic facts only, and for such exercises answers are not included in this *Teaching Guide.* For other types of exercises that come later, the answers are given, and there are also Teaching Charts in the Lesson Briefs. These charts refer to pages in the children's book that are to be used for remedial work. When test results indicate that a child has forgotten or needs additional learning experience, help him to find and restudy the appropriate pages in his book. Your pupils should gradually become accustomed to looking back on their own to pages studied earlier when they are uncertain about how to get an answer to a problem or a computational exercise.

There is much more to be gained from the administration of the tests than finding out whether or not the child gets the correct answers. The wise teacher will note the work habits of the children and the procedures they use in getting their answers. A quiet excursion around the room during which you make such observations will pay great dividends. Some of the things you should watch for are: the speed and assurance the child has in his work, evidence of frustration and hesitation, resorting to procedures such as counting on fingers or making marks on paper, and erasures that indicate faulty knowledge of basic facts or complete change of mind about the procedure. All of these should be noted and used in planning remedial work and further instruction.

Only a sampling of the addition basic facts is given in the tests on page 17. But it is enough to show you whether or not the child has a good grasp of the basic facts. If he can perform almost perfectly, you can assume that he is adequately prepared. If not, he will need more learning experiences before we proceed with the work that follows. Suggestions are provided in the section "Helping the slow learner."

Helping the slow learner

For the very slow learners a flannel board may help in visualizing the results of addition basic facts that are causing trouble. For instructions for making the flannel board, see Activity 4, page 331. To give practice in the addition basic facts, have the pupil place a group of felt cutouts on the board, saying the number as he does so, such as "4 apples." Then have him put another group on the board, describing the action taking place and the result—for example, "plus 5 apples equal 9 apples." Next have him state the action and the result in abstract terms ("4 plus 5 equals 9").

Individual practice cards with only the addition basic facts that are causing each child trouble should help also in eliminating difficulties. See Activity 5, page 332, for details.

Review of the addition basic facts for the 6 to 10 groups (basic facts whose sums are 6, 7, 8, 9, or 10) is provided for slow learners in a game called "Get-a-row." See Activity 6, page 332. This game may also be adapted for the 11 to 18 groups.

For a review of the addition basic facts for the 10 to 18 groups (basic facts whose sums are 10, 11, 12, 13, 14, 15, 16, 17, and 18), children may enjoy playing the game "Double Solitaire." See Activity 7, page 333, for a description of the game and the materials needed.

18-19 Learning how

Lesson Briefs for this lesson are on pages 29-30.

Overview

The work on these two pages is presented by means of the four-step teaching method: SEE, THINK, TRY, DO. The SEE and THINK steps on pages 18 and 19 provide material to be used by the group as a whole, under the direction of the teacher. The material in the TRY and DO steps on page 19 is intended to be worked through independently by the children. Be sure to see the complete discussion of this four-step teaching method on page 29 of the Lesson Briefs.

Note that the portion of the picture not under direct discussion in connection with the computation is "dimmed off" (for example, the 6 acorns in Picture B). This device helps you teach the child to focus only on the pertinent parts of the picture. The figures under discussion are in black in the computation.

Teaching the whole class

Page 18: To start this lesson, pupils may read the problem opposite Picture A, omitting the equation. Then have them look at Picture A and identify the group of acorns that belongs to each girl. Next tell pupils that directly beneath the problem they will find a statement of the problem in numerals and signs. Tell them that they are to call such a statement an *equation.* Then ask them if they can tell what kind of action they imagine is taking place in the problem. They should think of a combining action. Remind them that a plus sign is used to show the action of putting groups together. Then ask again for the num-

ber of acorns in each group and write the numerals on the board using the plus sign. Finish by writing the equals sign and putting a screen or square in place of the missing number. Explain to the children that the screen indicates a missing numeral that they must find. Have someone read the equation in the book. Explain to him that he should say "what number" when he comes to that part of the equation where the number is missing. Ask him to read the sentence that tells what he must find to solve the problem.

Then go on somewhat in this manner:

Compare the sentence opposite Picture B with what you see happening in the picture. Notice that the acorns we are paying attention to now are pictured in strong color, while the acorns we are not doing anything with are dimmed off. Now look at the numerals at the right. You can see that the same numerals we had in the equation have been rewritten in a column. We say that they are in the computational form. The two numerals printed in black represent the two groups of acorns in strong color in Picture B. What is happening to these two groups of acorns? How can you use the two numerals in black to do what the picture shows? You should know the sum of 7 plus 8. What is the sum? What should you do with the 15?

Treat Picture C and the accompanying text material in much the same way. Children should see that the group of 6 acorns is being combined with the group of 15, and that to do the same with the column of figures, they must add 6 to the remembered 15. Before they add mentally, ask them if they think the answer to 15+6 will be in the "teens" or the "twenties."

Ask "How do you know?" Then have them look at Picture D, where they will see that when all the groups have been combined, the objects can be rearranged so that there are two groups of ten and 1 left over. Have someone tell how many 2 tens and 1 one are. Direct attention to the computation. Ask if the 2 is in tens' place and the 1 in ones' place. Also have pupils look at the equation with the answer written in it.

Let any children who seem to be having difficulty in understanding this problem use objects or one-inch squares of paper to dramatize what they see happening in the pictures. As they complete each step, refer to the computation beside each picture and compare it with what they have just done with objects.

Page 19: In the THINK step at the top of page 19, have pupils first read the question. Then ask them to make up a problem involving the groups of butterflies. It might be something like this: "Groups of 2 butterflies, 4 butterflies, 7 butterflies, and 3 butterflies were flying toward a bush. How many butterflies were there in all?" Let a pupil explain the numerals and signs in the equation in terms of the problem and tell why the equation is correct. Then point out to the pupils that they are not told how to do the computing, but are asked questions that will help them do it correctly. Point out, too, that this time they must add four numbers instead of three.

As the pupils read the questions opposite the computation, ask such other questions as:

What is the sum of 2 and 4? What is the sum of 6 and 7? Will the sum of 13 and 3 be a "teen" number or a "twenty" number?

You might ask one of the abler pupils to go to the board and draw X's to show how the butterflies in the picture can be regrouped to show 16 as 1 ten and 6, just as the acorns were regrouped in Picture D on page 18.

As an extension of the work in the THINK step, you can draw on the chalkboard groups of squares or X's. (If a flannel board is available, you can put objects on it in groups. See Activity 4, page 331, for directions for making the flannel board.) Then ask the children to tell how many are in each of the groups they see. Tell them to write these numerals in a column on their papers and find the total number of all the groups.

The TRY step has been provided to give the children an opportunity to try out their skill at adding more than two one-figure numbers. Let the children work independently, progressing at their own rate of speed. Tell them to write the numerals in each of the equations (without the answers) in columns on their papers, label them with the appropriate letters, then close their books and add. As they finish each exercise, tell them to compare the answer with that given in the book. You can help those who seem to be having difficulty. The able children will probably find adding a column of figures fairly easy to do. As soon as you see that they have finished two or three of the exercises correctly, tell them to go on to the problems and exercises in the DO step. The slower children, however, should finish all the exercises in the TRY step before going on.

The problems and exercises in the DO step should be treated as written work. When everyone has finished the problems, provide answers, and let the children compare their answers with those you provide. You might suggest to the able pupils that they do not need to write the numerals in column form. They can copy them in equation form and add "in

their heads" and put the answers on their papers in place of the screens in the equations.

Providing for the able pupil

As the able pupils finish their work in the exercises in the DO step, you might suggest to them that they make up columns with *five* one-figure numbers in them and find the sums. From their previous work with four-figure numbers, they should be able to make generalizations and do this addition easily. Tell the pupils who are doing this work to exchange papers with one another and check the sums.

The game of Number Scrabble will also provide practice in adding one-figure numbers. See Activity 8, page 334, for complete details.

Helping the slow learner

If any of the slow learners have difficulty remembering the number they must keep in mind when adding the next figure in the column, let them write this intermediate number at the left of the column for a time.

The game of Target Toss may be used to furnish practice on column addition of one-figure numbers. See Activity 9, page 335, for details on materials needed and on how to play the game.

20-23 Learning how

Lesson Briefs for this lesson are on pages 31-33.

Overview

In previous lessons children reviewed the addition basic facts, adding a column of one-figure numbers, and regrouping 10 ones into 1 ten and 10 tens into 1 hundred. These ideas will now be put to use in reviewing the process of addition of numbers that have two or more figures in them.

On page 20 children see that the ones are added first. The ones that result from this addition are written in the ones' column, and the ten or tens put in the tens' column. Accompanying pictures show the process as it is carried out with objects. On page 21 the tens are combined, and the sum is written in tens' place, completing the problem.

On page 21 a new problem is presented with questions rather than explanations, to stimulate the child's thinking. The adding of the numbers appears on page 22, and pictures again show the action with objects. On page 23 problems and examples are presented for tryout and practice. Some examples have three two-figure numbers to add and have answers that include hundreds' place.

Teaching the whole class

The four-step teaching method is again used so that children may *see* in pictures what is happening to the numbers, *think* why this is happening, *try* without help from the teacher or pictures what they have learned (aided in this step by worked-out examples), and finally, *do* problems and examples entirely unaided. Additional examples are provided in the DO step for pupils who require extra practice. This extra set will be provided in all future "Learning how" lessons in the DO step. Throughout the lesson the portion of the pictures not under discussion in the accompanying text is dimmed off. In the computation, numerals under discussion are in black.

Page 20: Ask pupils to read Problem A and identify the shells that belong to each girl in Picture A. Pupils should understand that each box contains 10 shells. Ask them why they think the problem should be solved by addition. Then have someone read aloud the equation and the statement telling them what they must find.

By reading the first sentence opposite Picture B and then following the arrow to the picture, let pupils discover that they must put the ones together first. Have them notice that since they are not as yet combining the boxes of ten, these boxes are dimmed off. Direct attention next to the computation. Ask what is being put together in the picture (the ones), and lead them to see that the same thing is to be done in the computational form. Call attention to the fact that the figures for the ones are in black. Ask the class to add mentally. Let someone give the answer.

Now direct attention to Picture C and discuss what is being done with 10 of the 14 shells. Be sure to arrive at the reason for doing this. Then refer to the computation by procedures and questions like these:

Now let's see what we do in arithmetic. When we added 8 to 6, what did we get? We know that 14 is 1 ten and 4 ones. Read the sentence that tells where you should put the figure 4. Why is it put under the 8 and 6?

Now ask the children to explain what is being done in Picture D. Be sure they can explain why the 1 ten is written above the tens' column in the computation. They should understand, too, that it stands for the box of 10 shells that is being put with the other boxes of 10.

Page 21: Ask pupils to explain what is being done in Picture E. You might say:

How many boxes of 10 are there in the picture? What numbers in the computation would you add to find out how many tens there are? Do the adding in your head. Be sure to add the new ten. Did you get 9 tens? How many tens and how many ones are in the answer?

Then direct attention to Picture F. Have the pupils read the sentence and the equation. Ask:

Do you see 9 tens and 4 ones in the picture? Are 9 tens and 4 ones 94? How many shells are in the picture?

The problem in the THINK step should be treated in the same way as the one in the SEE step. The questions in the text are designed to guide the children's thinking. Pupils should be able to answer the questions by examining the accompanying illustrations and applying what is done in the pictures to the figures in the example. The lesson continues on the following page.

Page 22: In finishing the discussion of the problem begun on the preceding page, make sure the children understand each part of the process illustrated in Pictures A to F so that when you go on to the TRY step on page 23, the class will be prepared to work with little or no assistance from you.

Page 23: Tell the children that you expect them to do all the work in the TRY step by themselves. Instruct them to read each problem, rewrite the numerals in computational form on their papers, and do the addition. Explain that when they have *three* two-figure numbers to add, the method of adding will be exactly the same as the one they have just learned to use. Point out, too, that if they should get more than 9 tens in their answer, they should know how to write the number by using hundreds. Call attention to the statement at the right of the computational form for Problem B, which tells children that they do not have to write the number of tens brought over from the total number of ones if they can remember it. Tell the children that after they have done each problem they should verify their work by comparing it with the completed work in the book. Slow learners may still need some assistance. Those who appear to be making satisfactory progress should be told to proceed with the DO step as soon as they feel ready for it.

For the DO step, children are to write the computation and answers for Problems and Exercises A to N. Tell them to label each computation and answer with the letter it has in the book. When this assignment has been completed, provide answers and let each child verify his own work.

Exercises A to F may be assigned to those children who require more practice.

Providing for the able pupil

If the able pupils finish with the examples in the DO step ahead of the rest of the class, they might enjoy constructing and using an abacus that can be used for adding and subtracting two-figure and three-figure numbers. See Activity 10, page 336, for directions for constructing and using the abacus.

Helping the slow learner

Slow learners should be permitted to write above the tens' column in their computation the number of tens they are carrying.

The game of "Cork Drop" should provide interesting practice in adding two-figure numbers. See Activity 11, page 336, for complete details.

A game played with bean bags can also provide practice in adding two-figure numbers. For instructions on making the board and how to play the game, see Activity 12, page 337.

24-27 Learning how

Lesson Briefs for this lesson are on pages 34-36.

Teaching the whole class

As in the previous lesson, the four-step teaching method is used, and the work should be handled as it was in that lesson.

Before beginning the lesson, you may find it profitable to review briefly the ideas of regrouping tens into hundreds, and hundreds into thousands. Ask such questions as:

14 tens are how many hundreds and how many tens? 11 tens are how many hundreds and how many tens? 10 hundreds are how many thousands? 17 hundreds are how many thousands?

Page 24: To begin work with this page, introduce the idea of adding by saying:

Suppose you have 35 pencils in one box and 67 pencils in another box. How many pencils do you have in all?

Let the child who volunteers show how to get the solution on the board. This will provide for the class a review of the ideas used in the preceding lesson on adding two-figure numbers. Then continue as follows:

Suppose that instead of 35 pencils you have 135 pencils, and instead of 67 pencils you have 267. Would that be a lot of pencils? How would you find out how many you have in all?

Allow time for discussion. Then have the pupils open their books to page 24, where the pictures will make the situation clearer.

Then go on by having the children read the problem and match the groupings in Picture A with the numbers stated in the problem. Procedures suggested in the Expanded Notes for page 20 may be adapted for the remainder of page 24. Be sure the children relate the black numerals in the computation to the undimmed portions of the corresponding picture.

Page 25: For Picture E, make sure pupils see that the bundles of ten are being combined and relate the addition of the numerals in the tens' column to the action shown in the picture. Ask the children what can be done with the 10 tens. They should reply that a new hundred can be made. Direct attention to Picture F. Make sure they realize that there are no bundles of ten left. Relate this fact to the zero in the answer in tens' place. Pupils should note next that in Picture G the new box of 100 is being put with the other hundreds and that the small numeral 1 that represents this new box of 100 has been put above the other numerals in hundreds' place.

Then have pupils look at Picture H and compare what has happened with the computation that has been done in the hundreds' column. Have someone read the completed equation and the statement that follows.

Page 26: To begin the work, let the children read the problem and find in Picture A the groupings of hundreds, tens, and ones that match the numerals in the problem. Ask one of the children to explain why the equation is correct. Then call on pupils in turn to answer all the questions on the page. They should be able to find any answers they do not know by looking at the pictures.

Page 27: Since this is the first time that an answer in the thousands is to be obtained, some discussion of Example D may be necessary before the children put their knowledge to use in the TRY step. After Example D has been discussed, let them proceed at their own rate of speed as they did in the TRY step on page 23. Tell them they may begin Exercises A to P of the DO step as soon as they feel able to work entirely on their own. The remaining exercises may be assigned to those who need additional practice.

Conclude the work by having someone read aloud the statement opposite the flag at the bottom of the page. Try to get the children to formulate, in their own language, generalizations that tell what to do in adding two or more three-figure numbers.

Providing for the able pupil

Able pupils may like to try adding four or five numbers with three figures in them. Give them a few problems, and ask them to identify quickly those in which they must carry a ten, a hundred, or both. Later, you might let them complete the computation.

The game of "Number Scrabble" can be used to give a pair of able pupils practice in adding two-figure and three-figure numbers. If the game has already been introduced in connection with adding a column of one-figure numbers, the squares with letters on them may be used, but a new board with two-figure or three-figure numbers (or a mixture of both) in the squares will have to be made. See Activity 8, page 334, for details on making and playing the game.

The abacus (Activity 10, page 336) may also be used to give practice in adding three-figure numbers.

Helping the slow learner

The following three games may be adapted for use with three-figure numbers: Target Toss (Activity 9, page 335), Cork Drop (Activity 11, page 336), and Bean Bag (Activity 12, page 337).

28-29 Using arithmetic

Lesson Briefs for this lesson ore on poges 36-38.

Overview

This is the first "Using arithmetic" problem lesson in the book. Twenty simple problems involving addition are presented. For these the children are expected to make equations that describe the problem situations, rewrite the numbers in computational form, if necessary, and find the answers. On page 28 the pattern for each equation is set up. The correct numbers are supplied for the first four problems. For the problems on page 29, no such help is given. Children must make their own equations, based on the information obtained from the problems.

Children who used *Seeing Through Arithmetic 3* will be familiar with these problem-solving procedures. For others, it is important to build the habits of thinking of the problem in terms of the action taking place (or imagined to be taking place) and of writing equations for it. The children should always make the equation *before* they attempt any computation. The problem-solving program of the *Seeing Through Arithmetic* series emphasizes this procedure. It is suggested that before you begin teaching this lesson, you read the remarks on problem solving under "Comments" in the Lesson Briefs, pages 36-37, as well as pages 9-11 of the Guiding Principles.

Teaching the whole class

Remind the children that besides having just reviewed addition of numbers with one, two, and three figures, they have met a few addition problems. Ask:

Do you remember that immediately following every problem there was an equation that gave the facts of the problem in a simple way, using the numerals, a plus sign, an equals sign, and a screen? Now you are going to learn how to make your own equations.

Ask the children what kind of action is indicated by the plus sign. Then ask five or more children to

come to the front of the room to act out a situation showing the combining of two groups. For example, 2 children might walk over to join 3 children. Let someone else in the class write on the board the equation for the action (3+2=5). Be sure all the children understand that the plus sign indicates that one group is joining another group.

Page 28: Have the children read Problem A. Then tell them to look at Picture A. Ask a pupil to explain how Picture A illustrates the problem. Tell children that the first thing they should do in solving this problem is to make an equation. To help them express the action of the problem as an equation, ask specific questions such as:

How many books were on the table at first? How many more books did Bill's mother put on the table? What sign should you use in the equation to show that more books were being put with those already there? What numerals will you use to make the equation? Which numeral should you put first? Why? Which numeral should come after the plus sign? Why? What do you use to indicate a missing numeral? [A square will do.] Now look at the equation for Problem A in the book. Does it look the way you said it should? Who can give the missing number?

Have someone go to the chalkboard and write the equation with the answer.

Next have the class read Problem B and look at Picture B. Explain that since the problem does not say that the fish in one tank joined the fish in the other tank, we must imagine that the fish in one tank are put with the fish in the other tank. We must think of them as one group. Next have children look at the equation in the book and call on someone to explain each part of it in terms of the problem. Bring out the fact that the person who made the equation imagined the 6 fish as being put with the 4 fish.

Ask the children if they can imagine the 4 fish as being put with the 6 fish. Ask someone to come to the board and write the equation that shows this situation. Tell the class that since there is no *real* action indicated in the problem, they can imagine either group of fish joining the other group. Therefore, they can write either equation (4+6=10 or 6+4=10). Tell pupils that they will often have problems for which there are two possible equations, both of which are correct and will give the same answer.

Now call attention to Problem C. Ask the children to imagine the water in the two tanks poured into one larger tank. Tell them they can imagine either amount of water poured in first. Ask them which tank of water was poured in first according to the equation given in the book. Ask a pupil to write on the chalkboard an equation showing that 6 gallons were poured in first. Have him give the answer.

Treat Problem D in the same way. For Problem E, discuss the reason why 19+12=▒ is better than 12+19=▒. (He found 19 shells first.) This time pupils must visualize the combining action, since there is no picture. Tell children that after they have written the equation, they should put the numbers in computational form and add to get the answer. Help them to write the numbers and do the adding on the board. Tell them that whenever they have problems with large numbers, they should write the equation first and then put the numerals in computational form so that they can add them. When they get the answer, tell them to rewrite the equation and put the answer in the place where the screen was. Or they can write the answer over the screen or in the square in their original equation.

In Problems F to H, let the children decide whether there is real action taking place or whether they must imagine something as happening. Wherever they decide there is imagined action taking place, be sure they realize that two equations can be made, but that they need write only one. Let children take turns at the board writing the equations for the problems and solving them. In problems involving two-figure numbers the children should write the numerals from the equation in computational form and add.

Page 29: For Problems I to T the children are expected to make the equations entirely on their own. Work Problem I with the class, putting the equation on the board. Then have the class write on their papers after the appropriate letters the equations for each problem, with a screen or square to indicate where the answer should be. Then they should add, using the computational form if necessary. Finally, they should rewrite the equations, this time writing the answers in place of the screens. Or if they have made squares, tell them to insert their answers in the squares in their original equations.

Supply answers for the children, so that each may check his own work. To do this, you might write the answers on the board after the entire class has finished the problem set. Another way is to have the answers ready on a sheet of paper at your desk. The first pupil who finishes can then check his work, copy your answers on another sheet of paper, and return the two copies to your desk. These can be used by other pupils as they finish their work. If necessary, additional sheets of answers can be prepared by other pupils as they finish.

When all the pupils have checked their work, find out which problems caused the most trouble and center class discussion on them. For the problems that only a few children missed, let those who got the correct answers work with the others.

If there is plenty of time and sufficient board space, ask various pupils to put solutions for the problems on the board. Then discuss the solutions and help them determine whether the answers are right or wrong. The pupils who remain at their seats can check their work against that placed on the board.

Providing for the able pupil

Addition problems may be cut from old textbooks and pasted on 3″ x 5″ cards to give pupils practice in making equations for problems and solving them. Be sure the problems do not exceed the range of the processes taught so far. See Activity 13, page 337.

The able pupils might enjoy demonstrating for the rest of the class how to make the equations for the problems in the text. See Activity 14, page 338, for one way in which this might be done.

Helping the slow learner

Activity 13, page 337, may be adapted for the slow learners. Give these children cards on which the addition problems involve only basic facts. Then ask them to write the equations with a screen (or square) for the missing answer. Let the pupils use objects to make groups as indicated by the problem. Have them demonstrate the action in the problem and get the solution through the completion of the action. Finally, ask them to rewrite the equation, with the answer inserted in place of the screen (or square). An able pupil may supervise the work of a group of slow learners, if you wish.

29 Checking up

Lesson Briefs for this lesson are on page 39.

Expanded Notes are not considered necessary for this lesson.

30 Keeping skillful

Lesson Briefs for this lesson are on page 40.

Expanded Notes are not considered necessary for this lesson.

31 Checking up

Lesson Briefs for this lesson are on page 41.

Expanded Notes are not considered necessary except for suggestions for the slow learner.

Helping the slow learner

The flannel board described in Activity 4, page 331, may be used to give slow learners an opportunity to visualize the subtraction basic facts. Write a subtraction basic fact on the board. Then have a pupil place on the flannel board a group of cutouts equal to the first number and say, for instance, "7 apples." Then have him take away the group that is to be subtracted, describing the action taking place and the result, as "minus 4 apples equal 3 apples." Next have him state the action and the result in abstract terms as "7 minus 4 equals 3." An able pupil might supervise the activities of a group of slow pupils in practicing the subtraction basic facts in this way.

Individual practice cards with only the subtraction basic facts that are causing each child trouble is one way to stimulate practice and review. See Activity 5, page 332, for complete details.

Review of the subtraction basic facts for the 6 to 10 groups (basic facts whose minuends are 6, 7, 8, 9, or 10) can be provided for slow learners by use of the game called "Get-a-row." See suggestions in Activity 6, page 332.

CHARTING THE COURSE

Subtraction process

The process of subtraction is not new to pupils in Grade 4, but most if not all of them can profit from a review of it. In *Seeing Through Arithmetic 4,* pages 32-41 provide materials for a thorough reteaching of the subtraction process.

These lessons follow very closely those in *Seeing Through Arithmetic 3* in which pupils using this program are introduced to the process. The social settings of the problems and the numbers used are different, but

the procedures used are the same, and they are explained with equal care and thoroughness. Thus the pupils can readily recall their previous experiences. They, as well as the teacher, should recognize that if they understood the work of Grade 3, there is nothing really new to be learned from these lessons. On the other hand, their understanding may be refreshed and strengthened and their skill in the process increased by a systematic review that is designed to achieve both of these objectives.

In this book the first example of subtraction of two-figure numbers (42—27=▤) introduces the pupil to the idea of "borrowing." This is in accord with the principle that a truly representative example should be studied if the pupil is to gain insight into the process as a whole. Just as in the process of addition, the pupil has been prepared to deal with this general example by his previous learning of the basic principles of the number system. In previous grades and in particular on pages 14 and 15 of this book, he has been shown how to reorganize a number by breaking up a group of ten to secure 10 ones, or by breaking up a group of one hundred to secure 10 tens, and so on. Hence this basic principle does not need to be learned along with the process of borrowing, but merely applied.

When the pupil has completed these lessons, he has been taught all he needs to know to subtract one whole number from another. The numbers used in the basic explanations are restricted to three figures, but on page 45 the pupil is shown how to subtract four-figure numbers. A special procedure, or short cut, useful when the minuend is a number like 6003, is shown later in a "Thinking Straight" exercise on page 54. In general, however, special treatment is not needed when the pupil understands the number system and is learning by meaningful rather than rote methods.

32-35 Learning how

Lesson Briefs for this lesson are on poges 42-44.

Overview

This lesson reviews subtraction of two-figure numbers. In the first problem children encounter borrowing. The previous experiences children have had in reviewing the number system on page 14, where tens are changed to ones and hundreds are changed to tens, should have given them the necessary background for understanding the operations involved here.

The four-step method is used in presenting this lesson. The SEE step is introduced on page 32, with pictures illustrating the subtraction of ones and the changing of 1 ten to 10 ones. On page 33 the tens are subtracted, and another problem is begun in the THINK step. This problem centers attention on subtraction from zero in ones' place, but nothing really new is involved. Page 34 completes the solution. Examples with answers are provided in the TRY step on page 35. The DO step on the same page provides practice.

Page 32: Before beginning the work on this page, you might like to find out how much the children remember about subtraction by letting them solve the first problem by manipulating objects. If it is not possible for each child to have 42 objects, separate the children into two or three groups and give each group of children 42 objects (such as pencils or sticks), arranged in tens and ones. Then ask them to take 27 from the total group. Raise a question as to what they should do first, since they cannot take 7 from 2. When one of the groups of children has found the answer, have one child in that group write it on the board. Then suggest that this group arrange the objects again in tens and ones and show the rest of the class how to take 27 objects from 42 objects.

Now tell the children that in the book there are pictures that show how to subtract the numerals that represent objects. Tell them to open their books to page 32. Before proceeding further with the work on the page, give the children a chance to discuss any shells they may have collected.

After pupils have read the problem, call attention to Picture A. Make sure they realize that there are 10 shells in each of the boxes. Next have them look at the equation and explain the action that the minus sign stands for.

Now direct attention to Picture B and discuss what is happening. Remind the pupils that three of the boxes of shells are dimmed off in this picture because they are not being used at this time. Then have them look at the computational form. Let someone explain which figures are the tens and which are the ones and read the explanations.

Have someone explain what has happened in Picture C and, correspondingly, in the computation at the right. Then have children note in Picture D that 7 shells are being taken away. In the computation they can see that the ones have been subtracted.

Page 33: Get children to note that the tens are given special attention in Picture E. Ask what is happening and why two boxes are being taken away. Then have them relate what is happening in the pic-

ture to the computation at the right. Ask them if 15 is the answer they got when they worked with their objects. They should note the 15 shells in Picture F, shown as 1 box of 10 shells and 5 single shells.

Next ask pupils to read the new problem presented in the THINK step. Call on one of them to read it aloud and point to the 50 pine cones. Have someone read the equation and tell whether it describes the problem correctly. Call on pupils to answer the questions that are a part of this THINK step. Help pupils note that even though the original group contains only tens, the subtraction situation does not differ from the one in the first problem. Here, just as in the preceding problem, one of the tens of the total group must be changed to 10 ones before the ones can be subtracted.

Page 34: Call on various pupils to answer the questions concerning what is happening with the pictured objects and the corresponding work in the computational form. Be sure the children realize that, once one of the tens has been thought of as 10 ones, the ones are subtracted in the usual way, even though there were no single ones in the total group to begin with.

Page 35: Have pupils read Problem A and try to solve it on paper. Tell them to compare their work with the completed example in the book. Help any of the children who have trouble. Permit those children who are not able to remember the changed figures when they borrow to write them. Do not insist that they remember them.

Then let pupils work Examples B to E at their own speed. They should compare their work for each example with that in the book. Discuss Example B in particular, and point out that they do not have to change tens to ones because they can subtract immediately without changing. Work with the children who are having trouble doing Exercises C to E. When the children have finished, have them work the problems and examples in the DO step. Let those pupils who have no trouble doing the exercises in the TRY step go directly to the DO step and try Exercises A to T on their own.

When everyone has finished, have pupils put the work for the most difficult examples (those missed by many pupils) on the board.

Exercises A to P may be assigned as extra work for those who need it.

Providing for the able pupil

"Always 10" may be played by individual children to give them practice in adding and subtracting two-figure numbers. See Activity 15, page 338, for a description of the game.

Helping the slow learner

Children who have difficulty with two-figure subtraction should have opportunities to go to a work table and manipulate objects grouped as tens and ones. Pencils and sticks should be available in the quantities necessary and used in the way described in the opening activity for page 32. If sufficient objects are not available, cardboard squares labeled 10 and 1 can be used. To regroup 1 ten into 10 ones (using cardboard squares), a square labeled 10 would have to be removed completely and 10 squares labeled 1 substituted.

36-41 Learning how

Lesson Briefs for this lesson are on pages 45-48.

Overview

In reviewing subtraction with three figures the children have to recall how to borrow from the hundreds' column. Since in reviewing the number system (page 14) they studied regrouping hundreds into tens, this operation is not really new.

On page 36 a problem that requires borrowing from both the tens' and hundreds' columns is presented. Subtraction of the ones is shown by pictures and accompanying examples of the computation. Page 37 shows that the tens can be subtracted only after more tens are made available. On page 38 the hundreds are subtracted. A new problem is introduced in the THINK step, with illustrations provided to help children get the answers to questions. This problem involves a situation in which there are no groups of ten to begin with, but the illustrations and worked-out example show that the method of computation is the same. The computation is completed on page 40. On page 41 problems and examples are provided, and the first example involving no borrowing is encountered.

Teaching the whole class

As in the previous lesson, the four-step teaching method is used.

Before beginning the lesson, you may find it worth while to review briefly the ideas of regrouping hundreds into tens and tens into ones, as presented on page 14. Then you might give the children further practice by directing them as follows:

Change 3 tens and 4 ones so that the number of ones will be a "teens" number. Change 4 hundreds 4 tens 1 one so that the number of tens will be a "teens" number.

Page 36: To get the children thinking about subtraction, review what they know about handling two-figure numbers. Say:

Suppose you had 82 pieces of chalk and you gave each of the 28 members of the class one piece. How many pieces would you have left?

Ask someone to solve this problem at the chalkboard. Then say:

Suppose there were 323 pieces of chalk in a box, and you gave away 158 pieces. How would you find out how many pieces of chalk were left in the box?

Let the children give their suggestions. Then have them open their books to page 36, where pictures and examples solve a similar problem situation. If pupils are able to solve the problem, tell them that they should compare their method with the work shown in the book.

Have the children read the problem and tell what the groupings in Picture A show. Procedures suggested in the Expanded Notes for page 32 may be adapted for the remainder of this page.

Page 37: Have children look at Picture E and tell what is happening and why. In Picture F they should see that there are now 11 bundles of 10, and only 2 boxes of 100. Have them note in the computational form at the right the corresponding changes in the figures. Ask the children if they can subtract the tens now.

Picture G shows the removal of 5 bundles of 10 pencils. Ask a child to explain how the subtraction is shown with figures.

Page 38: Let children explain what Picture H shows. Be sure they understand why 1 box of 100 is being removed. Have them refer to the computation. For Picture I, ask someone to relate the groups of pencils to the figures in the answer.

Handle the new problem and its equation and picture in much the same way as Problem A on page 36. Lead the children to decide that the ones must be subtracted first. Then ask:

Can we take 4 erasers from 1 eraser? Are there any boxes of ten to change into ones? We must have some tens before we can change one box of ten into 10 ones. Have you any suggestions about what we might do?

Tell pupils to read the question opposite Picture B. Discuss the action shown in the picture and relate it to what must be done in the computation.

Page 39: Have the children examine Picture C and explain what it shows. Then have them tell how the small black numerals in the computation were obtained and what they mean.

Ask the children if they now can obtain more ones. Have someone explain how Picture D shows that a box of 10 erasers has been opened to provide ones.

Picture E shows the result of the regrouping. Ask a pupil to explain the line crossing out the numeral 10 in the computational form and to tell where the 11 in the ones' column came from. Be sure the children understand that the picture and the small numerals represent the same total quantity of erasers as the original number (201 erasers).

Page 40: Direct attention to the removal of 4 erasers in Picture F. Then have pupils relate the subtraction in the computational form to the action shown in Picture F. For the remaining pictures and text material on this page, have children proceed in the same way. They should note the action in the pictures and relate it to what happens in the computational form at the right.

Page 41: Procedures suggested in the Expanded Notes for page 35 may be adapted for this page. Pay special attention to Example B in the TRY step, and bring out the fact that no borrowing is necessary. The second block of exercises (A to K) in the DO step should be assigned only to those pupils who seem to need more practice.

Providing for the able pupil

In Activity 16, page 338, you will find instructions for playing a game called "Get 30," which provides practice on addition and subtraction of two-figure and three-figure numbers.

The game of "1089" (Activity 17, page 339) provides able pupils with practice in adding and subtracting three-figure numbers.

Helping the slow learner

If the slow pupils continue to have difficulty in subtraction that involves borrowing twice, select examples for them that involve only one rearrangement of figures. Sometimes these examples can involve borrowing from the hundreds' column only; other times, from the tens' column only. When pupils seem able to handle these examples, provide examples with borrowing twice.

Also let children use objects, such as pencils and sticks, or squares with labels of 100, 10, and 1, to work out any examples that cause them trouble. See the suggestions under "Helping the slow learner" in the lesson on two-figure subtraction immediately preceding.

42-43 Using arithmetic

Lesson Briefs for this lesson are on pages 48-50.

Overview

This set of problems includes subtractive situations that involve real actions and those that involve imagined action. In the latter, the child must think of

a part of a group as being removed even though it is not really removed. Children learn to make equations that describe these real and imagined subtractive actions. On page 42 patterns for equations are provided, with numerals inserted in the first four problems. The problems on page 43 do not have accompanying patterns for the equations. Children must build their own equations, based on the information given in the problems.

Teaching the whole class

Page 42: Have the children read Problem A. Then ask them to look at Picture A. Call on someone to explain what is happening in Picture A in terms of the problem. Ask how many pieces of candy were on the plate at first, how many were removed, and how many were left on the plate. Ask another pupil what sign indicates that part of a group is being removed. Then ask him to go to the board and use the numerals in the problem to make an equation that tells what happened in the problem. Have the class compare his equation with the one in the book. Let someone give the answer and write it in the equation on the board.

Next call on six or seven children to come to the front of the room and show a subtractive situation. For example, the six children could stand together in a group and four of them could walk away. Two would remain. Ask one of the class members to state the equation they demonstrated and tell the answer. Have him write it on the board, too.

Now direct attention to Problem B. Have pupils read it, without the equation. Then have them look at Picture B. Ask:

How many cupcakes are on the tray? Does the picture show any of the cupcakes being removed? Do all the cupcakes look the same? The problem says Carol's mother put frosting on how many cupcakes? Find these cupcakes in Picture B.

The problem asks you to find how many cupcakes were left plain. If you cover up the frosted cupcakes with your fingers, how many are left? How many unfrosted cupcakes are there? When you covered the frosted cupcakes with your fingers, were you, in a way, removing them from the picture? Does this suggest subtracting? Do you think that instead of removing them this way, you could just imagine them as gone?

If you imagined the six frosted cupcakes as gone from the whole group, would this suggest subtracting? Who will come to the chalkboard and write the equation that he thinks would show the story of this problem? What number should come first? What sign comes next? What is the number that tells how many we should imagine as gone? Finish the equation with an equals sign and a screen to stand for the missing number. What is the answer?

Discuss Problem C in a similar way. Since there is no picture for this problem, the children must imagine the 9 flowers that were open as gone.

Work Problem D with the class. This problem concerns real action, but the subtraction required is not one of the basic facts. Remind children that after they write the equation with a screen or square, they may need to put the numbers in computational form before they can subtract. Direct the children to write the answer in the square of the equation, or to rewrite the equation with the answer in place of the square or screen. Use whichever method you prefer, but be consistent.

Problems E to G should be handled orally, too. Ask questions that help the children see what numbers fit in place of the screens. For Problem H, help the children formulate the equation.

Page 43: Assign Problems I to U as written work. Remind the children that for each problem they are to write the equation first with a screen or square. Then they are to put the numerals in computational form and compute. Finally, the pupils should rewrite the equation with the answer written in place of the square or screen. Or they may write the answer in the square or over the screen in their original equation.

Afterward, supply answers (see suggestions in the Expanded Notes for pages 28 and 29), and let the children verify their work. Discuss in detail the problems that caused the most trouble.

Providing for the able pupil

Subtraction problems may be cut from old textbooks and pasted on 3″ x 5″ cards to give pupils more experience in making equations and solving problems. Be sure the problems do not exceed the range of the processes taught so far. Activity 13, page 337, gives complete details.

See also Activity 14, page 338, for details for an activity involving the demonstration of equation-making by the able pupils.

Helping the slow learner

Activity 13, page 337, may be adapted for the slow learners. Give these children cards on which the subtraction problems involve only basic facts. Then ask them to write the equations with screens or squares for the missing answers. Let the pupils use objects to make groups as indicated by the problems. Have them demonstrate the action (real or imagined) in the problems and get the answers by completing

the action. Finally, ask them either to rewrite the equations with the answers in place of the screens or squares, or to insert the answers in the squares in the equations. An able pupil may supervise the work of a group of slow learners, if you wish.

43 Checking up

Lesson Briefs for this lesson are on pages 50-51.

Expanded Notes are not considered necessary for this lesson.

44-45 Using arithmetic

Lesson Briefs for this lesson are on pages 51-52.

Expanded Notes are not considered necessary for this lesson.

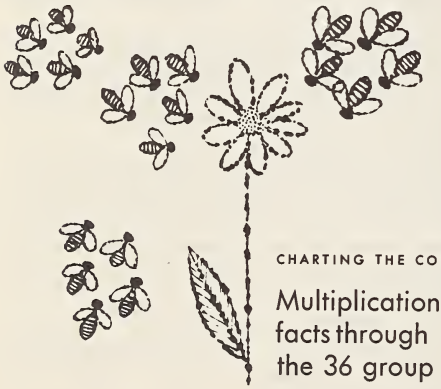
45 Keeping skillful

Lesson Briefs for this lesson are on page 53.

Expanded Notes other than suggestions for the able pupil are not considered necessary for this lesson.

Providing for the able pupil

The game of "Always 10" described in Activity 15, page 338, may be used to give practice in subtracting four-figure numbers.



CHARTING THE COURSE

Multiplication facts through the 36 group

In the *Seeing Through Arithmetic* program, the meaning of multiplication and some of the multiplication basic facts are introduced in Grade 2. In that grade the treatment is informal, the experiences are looked upon as providing readiness rather than mastery, and the facts are confined to those in which the products do not exceed 10.

In *Seeing Through Arithmetic 3*, the meaning of multiplication is carefully developed, and all the facts for which the products do not exceed 36 are taught. Pages 46-53 of *Seeing Through Arithmetic 4* provide a thorough review of both the meaning of multiplication and the basic facts through 36.

In this book the facts are organized in terms of the products. For the 12 group, for example, the multiplication facts are $3\times4=12$, $4\times3=12$, $2\times6=12$, and $6\times2=12$. These are all taught together. Later, if desired, an activity in which these known facts are arranged in their proper places in "multiplication tables" may be used. The child should, however, be expected to know the fact without reliance upon a table. Moreover, he should be able to recall it immediately without recourse to any relationship of the wanted fact to some other fact that, presumably, he really does know.

Teachers should observe that the meaning of multiplication is based on multiplicative action—the combining of equal groups. When a situation is observed multiplicatively, four things are evident. First, some groups are to be combined—actually or by imagination. Second, the number of objects in each group must be noted. Third, the fact that they are equal groups must be observed. Fourth, the number of groups must be noted. Multiplicative situations are not the same as additive situations. When a situation involving several groups is observed additively, no attention need be given to whether or not the groups are equal, and the number of groups involved is of no importance. The groups may or may not be equal.

Many books for teachers and pupils have taught that "multiplication is a short way of doing addition when the addends are all equal." This is a statement about the *process* of multiplication. It says that a multiplicative situation can be processed by addition, but this statement does not clarify the *meaning* of multiplication. Moreover, since it focuses on an alternative to the process of multiplication instead of the *meaning* of multiplication, it contributes very little to problem-solving abilities. *Seeing Through Arithmetic 4* develops meaning by emphasizing the basic multiplicative aspects of certain situations—the recognition that equal groups are to be combined, and that only two numbers are involved. One of these numbers specifies the size of the groups, and the other specifies the number of groups.

Some vocabulary difficulties arise in connection with multiplication and division. Children should learn the meaning from actual manipulation of objects and from study of pictures of objects so arranged that equal subgroups can be recognized. If they acquire meanings in this way, the question as to whether one should say "2 threes are 6" or "2 times 3 is 6" is unimportant. One of these verbal expressions is no more "meaningful" than the other. Both are merely ways of stating a situation, and it is the situation that is, or is not, meaningful. Both statements are in common use, and both should be taught.

In the situation described by "2 threes," it is conventional, at the present time in this country, to write the numeral representing the number of equal groups at the left, and to call it the *multiplier*. Thus, in 2×3, the symbol $\times$ (read "times") indicates multiplication, and the whole expression represents 3 multiplied by 2.

In the case of division—for example, $12\div4$—the expression is read "12 divided by 4," and there is no single word or name for the division symbol ($\div$) between the numerals. In this expression $12\div4$, the *divisor* is at the right. When 2×3 is read "2 multiplied by 3" and 3 is regarded as the multiplier, a strict parallelism exists between the verbal expressions for multiplication and division. The modern tendency to use expressions like "2 threes" and "2 times 3" has broken down this parallelism and creates a situation that sometimes leads to difficulty when the basic concepts are not made clear by using objects and pictures. It is hardly possible to overemphasize the principle that verbal distinctions are of little or no help to the pupil and can safely be ignored if the underlying multiplicative and divisive situations are adequately taught. Instead of emphasizing a particular way of stating a multiplicative situation, all of the ways in common use should be taught.

46-48 Looking back

Lesson Briefs for this lesson are on pages 54-56.

Overview

The work on these pages will help you discover how well the children know the multiplication basic facts with products through 18 and how well they understand the meaning of multiplication.

On page 46 the multiplication basic facts $4\times2=8$ and $3\times3=9$ are shown pictorially, and other basic facts with products through 10 are reviewed in abstract exercises. The pictured basic facts demonstrate the meaning of multiplication by showing what happens when equal groups of objects are combined.

On page 47 the combining of equal groups must be imagined. Objects are viewed first as separate equal rows and then as combined into one group. Since the rows can be viewed both horizontally and vertically, each picture shows two multiplication basic facts (as in Picture C, where $3\times4=12$ and $4\times3=12$ are shown). Basic facts for the 12, 14, 15, and 16 groups (basic facts whose products are 12, 14, 15, or 16) are pictured. Since these products involve groups of objects numbering more than 10, a ring has been used to enable the children to see the total amount quickly. Pupils are taught to understand that the ring encloses 10 objects. They can quickly "see" the remaining objects, and should know from their study of the number system that a ten and so many ones makes a teen number.

Page 48 continues to show objects arranged in rows. Again a ring is used to indicate ten in the final product. Abstract practice in both the equation and the computational form is provided.

Teaching the whole class

Page 46: Before you begin work on this page, you may wish to use the sets of exercises at the bottom of pages 46 and 48 as a brief inventory test on the multiplication basic facts through 18. If certain facts cause general difficulty, you may wish to emphasize the pictures and text for these facts as you proceed with this lesson.

Since the theme of this block of work centers around a party at school, you might begin the work by letting the children tell about other parties they have attended and, in particular, what they had to eat. Then ask them to turn to page 46. Let them look over the page and identify the food.

Draw attention to the first scene of Movie A. Call on someone to tell how many popcorn balls are on each plate and, how many plates of 2 popcorn balls each there are. Help him to see that there are 4 groups of 2 popcorn balls. Then have him tell what has happened in the second scene. Ask how many popcorn balls are in the basket. If he has learned to recognize groups, he should see 8 immediately.

Point out that four groups of 2 have been combined to make 8. Call attention next to the accompanying problem and let the class read it silently. Tell the children to get the answer from Movie A. Then explain that all the statements that follow are different ways of describing the problem situation and telling what happened. Discuss each of these statements. Be sure the pupils understand that the 4 stands for

the number of equal groups and the 2 for the size of each group. Let pupils take turns reading the statements and giving the answers. Be sure they understand that the "times" sign ($\times$) is used to show multiplication. When they get to the computational form, explain that this form is the one they will use later when they multiply larger numbers. Explain that it is read "multiply 2 by 4."

Treat Movie B and its accompanying text in much the same way.

For Exercises A to H at the bottom of the page, first have the children identify, for each equation, the numeral that stands for the size of the group and the numeral that stands for the number of groups. The exercises may then be used for oral or written work, or both.

Page 47: Ask questions like these about Picture C: *How many spoons are there in each row across the page? How many rows of four are there? Think of the 3 rows of four as 3 groups of four. Now imagine that the 3 groups of four have been combined into one large group. What do you think of when equal groups are combined?* [*Multiplication*] *Three fours equal how many? The picture will tell you. Notice the black ring around some of the spoons. There are ten spoons inside the ring. How many spoons are outside the ring? What number is 1 ten and 2 ones?*

Now read the first line, John, and tell us the missing number. Sue, read the second line and tell us the answer. Janet, read the third line and tell the missing number. The second and third lines are different ways of saying the same thing.

Next ask pupils how many spoons there are in each up-and-down row. Continue with questions similar to those asked for the first part of this exercise. Finish by having the children read the three statements referring to the up-and-down rows.

If any of the slower learners have trouble in distinguishing the vertical from the horizontal rows, let them use small sticks to separate the rows. Also let them turn their books sideways, if necessary.

Some of the children may find it hard to think of these rows of spoons as combining into one large group. If so, let them use 12 objects and arrange them in rows to look like Picture C.

When the work with Picture C and its accompanying text has been completed, point out to the children that both 3×4 and 4×3 have 12 for the answer.

The remaining pictures and the text that accompanies each may be handled in much the same way. Continue to stress the function of the ring (to enclose 10 objects and thus make the total easy to determine).

Page 48: Work with the three pictures and their accompanying text in much the same way as you did for the two preceding pages. Be sure the children understand the purpose of the ring.

Exercises A to O may be used as written work. If you wish, you may direct the abler pupils to write the related basic fact underneath each equation. For example, in Exercise B, they would write $2\times6=12$ underneath $6\times2=12$. There is no reverse basic fact for Exercise A, of course.

Exercises A to E, in the computational form, may also be used as written work. If the abler children have time, let them write Exercises A to O in the computational form with answers.

Providing for the able pupil

The able pupil can review the multiplication basic facts (through the 18 group) by arranging the facts studied so far according to number groups. See Activity 18, page 339, for complete details.

After the children have finished this activity, they can use the multiplication facts as they arranged them to make practice cards. Have them write a group number on one side of a card and all the multiplication basic facts for that group on the other side. See Activity 19, page 340, for details.

The able pupils also might like to begin building multiplication tables. See Activity 20, page 340.

As a follow-up, the children could make practice cards from the multiplication tables. The number representing the size of the group should be on the front of the card, and on the back all the multiplication basic facts studied so far that have this number as the multiplicand. Full details are given in Activity 21, page 340.

Helping the slow learner

Multiplication practice cards, similar to those described in Activity 5, page 332, should help the children to eliminate individual difficulties with the multiplication basic facts reviewed so far.

Slower pupils who need more experience in manipulating objects might benefit from the use of sets of squares arranged in groups of 2 to 9. See Activity 22, page 341, for suggestions for their use.

The Hundreds' Board, described in detail in Activity 23, page 341, will also help the slow learners to learn the multiplication basic facts.

At this stage, small groups of two or three pupils enjoy working together with the various learning aids. They often learn the basic facts more quickly and efficiently under their own direction than under that of a teacher. Furthermore, they are adept at identifying the facts that cause difficulty for the individual and in finding ways to overcome the difficulty.

49-51 Looking back

Lesson Briefs for this lesson are on pages 56-58.

Overview

This lesson helps the children review those multiplication basic facts whose products are 20, 21, 24, 25, 27, 28, 30, 32, 35, and 36. Except for the pictures showing 5 fives and 6 sixes, each of the twelve pictures on pages 49-51 shows two related facts. Again the arrangement of the rows makes it possible to view them both vertically and horizontally. As in the previous lesson, children are to view the objects as rows first, then as combined to find the total. The ringing of tens enables them to "see" the total easily without counting the objects.

Teaching the whole class

Page 49: If you wish to inventory the children's knowledge of the facts through 36, the exercises at the bottom of page 51 may be used for this purpose before proceeding with page 49.

Tell the children that Picture A shows more of the cupcakes brought to school for the party. Pupils should first discover how many cupcakes there are in the top row and then how many rows of 5 cupcakes there are. Have them note the two ringed groups. Then ask how many tens are pictured here and what number is represented. Have the first three lines of text at the right read aloud.

Next have pupils view the rows vertically so that they can see 5 rows of 4 cupcakes and can determine how many they make when combined.

The remaining pictures and the accompanying text on this page should be treated in the same way.

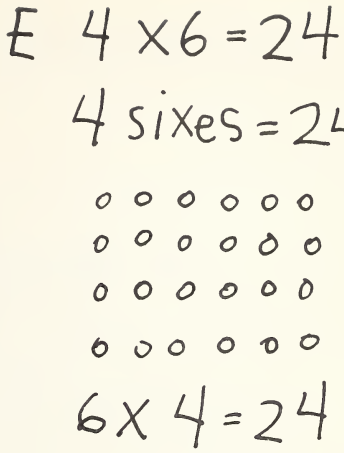
Page 50: The suggestions for page 49 may be adapted to the pictures and text on this page.

Page 51: Pictures J, K, and L and the accompanying text may be handled in the same way as the work on the previous two pages.

For Exercises A to V at the bottom of the page, have the children write each equation with its answer and, immediately after each one, write the related fact. For example, for Exercise A, they would write, "$8 \times 3 = 24$" and "$3 \times 8 = 24$."

For the last set of exercises, A to H, ask the children to do four things for each equation: write the equation with its answer; write the fact in another way; show the fact by a "picture"; and write the related fact in equation form. (There will be no related fact for A or for F.) A sample answer is shown in the next column.

Let the children use their ingenuity in the type of "pictures" they make. If they have no ideas of their own, suggest circles, triangles, X's, etc.



When the work with this lesson has been completed, the class might enjoy constructing a two-way multiplication chart to be displayed permanently in the classroom. See Activity 24, page 342, for a complete description.

Providing for the able pupil

Activity 18 may now be extended to include the multiplication basic facts through the 36 group. See Activity 18, page 339, for details.

If the practice cards described in Activity 19 were used in reviewing the multiplication basic facts through the 18 group, new cards can be added to the pack, using the number groups from 20 to 36. See Activity 19, page 340.

If the children have been constructing the multiplication tables suggested in Activity 20, page 340, let them include the basic facts with answers from 20 to 36.

Activity 21, page 340, may also be extended to include the basic facts the children have just reviewed.

Helping the slow learner

If certain basic facts in the groups 20 to 36 cause special trouble for the children, make practice cards for these facts. See Activity 5, page 332, for a description of the cards.

The paper squares suggested in Activity 22, page 341, may help the slower pupils visualize the multiplication basic facts for the 20 to 36 groups.

The Hundreds' Board, described in Activity 23, page 341, is another activity that will help the children visualize the multiplication basic facts.

A "football game" can be used to give the children practice in reviewing the multiplication basic facts through the 36 group. See Activity 25, page 343.

The game called "All-in-a-row" can also give practice in the multiplication basic facts. See Activity 26, page 344, for a description of equipment and details for playing the game.

52-53 Using arithmetic

Lesson Briefs for this lesson are on pages 58-59.

Overview

In this fourth set of "Using arithmetic" problems, there are multiplication problems only. The children learn to make equations that describe the multiplicative action—the combining of equal groups. On page 52 equation patterns are provided, with numerals inserted for the first four problems. The problems on page 53 do not have accompanying equation patterns. Children must build their own equations from information given in the problems.

Teaching the whole class

Page 52: Tell the pupils to read Problem A, but to omit the equation. Then direct attention to Picture A. Let the children describe the multiplicative action [the combining of 4 groups of 2 children]. Ask pupils how they can express what the picture shows and what the problem describes in an equation. Be sure they understand that the multiplier (standing for the number of groups) goes at the left of the "times" sign and the multiplicand (standing for the size of each group) at the right. Have someone write the equation on the board, with a screen (or square) indicating where the answer should be. Another pupil may write the answer in the proper place, inside the square (or in place of the screen).

Problem B should be treated in the same way.

For the rest of the problems on this page, there are no pictures to help the children. They must visualize each problem situation and imagine the combining action. Help them make the transition in their thinking from the objects mentioned in the problems to the number of groups and the size of the groups as used in the equation.

For Problems E to H, ask questions to help pupils see what numbers belong where the screens are.

Page 53: Go over Problem I orally with the class. Help the children make the equation. Then assign Problems J to P as written work. Remind the children that for each problem they should first write the equation, even if they know the answer. Tell them to make a square where the answer should be, then go back and insert the answer within the square.

Providing for the able pupil

To give pupils more experience in making equations for multiplication problems and solving them, problems may be cut from old textbooks and pasted on 3″ x 5″ cards. Also, the children might make some problems of their own. These can then be typed on cards. Be sure the problems do not exceed the range of the basic facts taught so far. Activity 13, page 337, will give complete details.

Helping the slow learner

Activity 13, page 337, may be adapted for the slow learner. Have him write the equation with a screen (a square will do). Then let him place objects in groups as indicated by the problem. Let him demonstrate the action in the problem and get the solution by completing the action.

53 Checking up

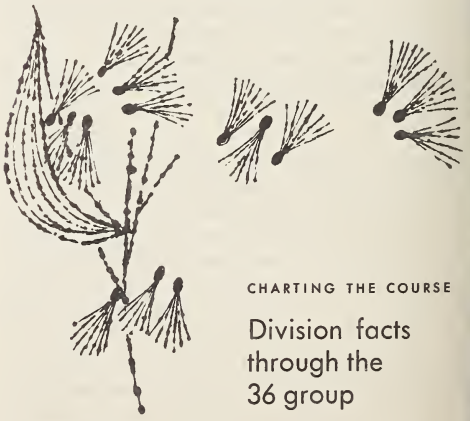
Lesson Briefs for this lesson are on page 60.

Expanded Notes are not considered necessary for this lesson. In working with these tests, you will want to reread the material in the Overview for the work on page 17 (pages 244-245 of this *Teaching Guide*).

54 Thinking straight; Keeping skillful

Lesson Briefs for these lessons are on page 61.

Expanded Notes are not considered necessary for these lessons.



CHARTING THE COURSE

Division facts through the 36 group

In the *Seeing Through Arithmetic* program the teaching sequence for division parallels that for multiplication. The meaning of division and some of the division basic facts are introduced in Grade 2. These informal experiences are for developing readiness, and the dividends do not exceed 10.

Seeing Through Arithmetic 3 develops the understandings that underlie division and introduces all facts for dividends that do not exceed 36. Pages 55-67 of *Seeing Through Arithmetic 4* provide a thorough review both of the meaning of division and of the basic facts through dividends of 36.

The meaning of division is based upon divisive action —the separation of a given group into equal subgroups. This separation can occur in two ways. First, if the size of each subgroup is known, the number of these subgroups in the dividend can be found. For example, how many groups of 4 can be made with 28 objects? The answer is "7 groups." This type of divisive action is called *quotitive*, or, more commonly, the "measurement" type. The latter term comes from the analogy to such measurement situations as the following: How many pieces of string, each 4 feet long, can be cut from a string 28 feet long?

Second, divisive action occurs when the number of subgroups to be made is known, but their size is not known. The size is to be found. For example, if a group of 28 objects is to be separated into 7 equal groups, how many will be in each group? The answer is "4 objects." This type of divisive action is called *partitive*; more commonly, the process is called *partition*. Often the idea of sharing is involved.

The *Seeing Through Arithmetic* program introduces quotitive division before partitive division, and the basic facts are all introduced by using quotitive situations. Partitive situations are introduced later, and in them the processing is done by quotitive methods.

In the earlier discussion of multiplication, attention was called to some of the different ways in which multiplication is stated. In that connection it was pointed out that there is no single word (or name) for the division sign (÷) and that this sign is read "divided by." Thus $12 \div 4$ is read "twelve divided by four." The computational form at the right may be read in the same way. (This form is included only because the child may occasionally encounter it. Its real value occurs when the child leaves the area of the basic facts and attempts to divide with larger numbers.) Efforts to make this form meaningful by reading the above example as "fours in twelve?" are likely to be futile. The meaning of division must develop from visual or physical activities involving the separation of a group into equal subgroups, and not from the verbal formulation.

$4\overline{)12}$

In this book the facts are organized for learning in terms of the dividends. Thus $12 \div 2 = 6$, $12 \div 6 = 2$, $12 \div 3 = 4$, and $12 \div 4 = 3$ are taught together. Later, these facts may, if desired, be arranged with others into "tables" of the division facts, but presenting them initially in "table" form offers no learning advantage. This organization in terms of the dividends corresponds to that used with the multiplication basic facts. However, the inverse relationship between multiplication and division is not stressed at this point.

55-59 Looking back

Lesson Briefs for this lesson are on pages 62-65.

Overview

The division basic facts for the 4 to 18 groups (dividends of 4 to 18) are reviewed in this lesson. On page 55 the facts for $10 \div 2$ and $9 \div 3$ are presented pictorially. Two-scene movies show the meaning of division—the separating of a group into smaller equal groups. The other division basic facts for the groups through 10 are also reviewed.

On pages 56-59 the remaining basic facts for the groups to 18 are presented pictorially. Only one picture is used for each basic fact here. The separating action of division is suggested by rings drawn around groups of equal size within the total group. Attention is to be focused first on the total group, then on the number in each smaller equal group (the number inside each ring), and then on the number of equal groups. The lesson ends with abstract exercises, some of which are in computational form.

Teaching the whole class

Page 55: Before beginning the work on this page, you may want to use the red-lettered sets of exercises at the bottom of pages 55, 56, 57, and 59 as an inventory to find out how well the children remember the division basic facts for the 4 to 18 groups. Use of these exercises before starting the work, will enable you, if you wish, to concentrate on the pictures and text that develop those facts most in need of review.

In any case, you will want to review the meaning of division. Movie A on page 55 shows a good way to do it. Have the children read the problem and then look at Scene 1 of Movie A. Ask:

What is going to happen to the cars? How many cars will be put into each box? Could the clerk put the cars in groups of two first? Look at Scene 2. The cars have been put into the boxes.

Let's use some sticks and paper and pretend that they are the cars and boxes. How many sticks

should I put down to stand for the cars? Jane, separate the cars into groups of two. How many groups of two are there? Each group of 2 cars will fill how many boxes? How many boxes do we need for the cars? Mary, put down 5 sheets of paper, and then put the cars on them in groups of two. Do the cars in the boxes look like Scene 2 of Movie A?

When we separate a large group into equal smaller groups, we call it "division." Read the first statement after the problem and say the missing number. Read the second statement and give the answer. Now read the statement beginning with the word Divide. *Look at the division equation that follows. That is what you should think when you see the first statement. Read the equation and give the answer. Now look at the computational form immediately below. Read it "Divide 10 by 2." Then give the answer.*

Remind the children that all these statements are different ways of stating the same situation. Then have them look again at the equation $10 \div 2 = \square$. Ask them on which side of the division sign the numeral standing for the total group is and on which side the numeral standing for the size of the group is. Ask what the answer shows. [The number of *equal groups*]

Problem B and its text may be treated in much the same way.

For Exercises A to H, have the children make two-scene movies like those in the text, showing objects (they may be X's) before they were separated into groups, and after they were separated into groups. (You might do the first example on the chalkboard.) Have pupils write the equation that shows what was done, giving the answer. You might ask the abler pupils to write other ways of stating the basic facts in these exercises (18 divided by 2, divide 18 by 2).

Page 56: Remind the children that division means separating or dividing a group into equal smaller groups. Tell them that on this page they are going to review the division basic facts for the 12 group.

If sufficient objects are available so that each child can have 12 of them, you might let the children rediscover the division basic facts for the 12 group.

Tell them to write the numeral 12 on a piece of paper. Then tell them to separate the twelve objects into smaller equal groups. They are to note the number of objects in each of the equal groups. Then direct them to write the division sign after the numeral 12 to show that they separated the objects into equal groups, and after it to write the number of objects in each group. Ask them to count the number of equal groups and write the equals sign and this number after the first part of their equation.

Let them repeat the procedure, this time separating the original group of 12 into equal groups of another size. Have them write the new equation directly under the first one on their papers.

Let the children repeat this experiment until they think they have discovered all the division basic facts for the 12 group. Tell them to keep their papers and look in their books to find a picture and a story that match each equation they have made. As they find the pictures and stories, they can check their equations off by making a mark of some kind (C, check mark, etc.).

If you wish, you may have one child do this experiment in front of the class and have the other children write each fact as it is discovered.

Next have the children look at page 56. Point out that there is only one picture for each basic fact instead of two. Explain that each picture shows both the original group and also the size and number of the equal groups into which the original group is separated. See if some of the children can discover how the pictures show this. If none can, explain that the black rings circle equal groups.

Start the work on the page by having the pupils read the first problem, using Picture C to get the missing numbers. You might ask one of the children to write the computational form with the answer on the board.

Problems D, E, and F and their accompanying pictures may be handled in the same way.

Use Exercises A to T first as oral work. Then have the children write the equations with answers, except for Exercises R and S, for which they need to write only the answers.

Page 57: The pictures and text on this page may be taught in the same way as page 56. To vary the procedure, you may ask the children to see if they can tell what the division facts are by looking at the pictures. Then have them read the text, filling in the missing numbers.

The exercises at the bottom of the page may be treated like those at the bottom of page 56.

Page 58: Adapt the procedures suggested for pages 56 and 57.

Page 59: Use similar procedures for Pictures P and Q and the accompanying text.

Exercises A to O in Block 1 may be handled first orally, and then as written work. Tell pupils to write the answers only after the letters. Use the second block of exercises for written work. Tell pupils that for Exercises A, D, F, I, M, and O, they are to write

each fact in equation form. If they have trouble doing this, tell them they can find the correct equation in the first block of exercises. For the other exercises in this block, they may give only the answers. Exercises A to P (the computational form) should be written as they are in the book, with answers inserted.

Providing for the able pupil

Activity 18, page 339, may be adapted to give practice in the division basic facts. See the suggestions given in the last paragraph of the activity description.

Practice cards arranged by number groups may be made for the division basic facts. See Activity 19, page 340.

Division "tables" may be made, as suggested in Activity 20, page 340.

Practice cards arranged by "tables," as shown and described in Activity 21, page 340, are another activity for the able pupils.

At this time the able pupils should use for division the chart made in connection with multiplication in the lesson for pages 49-51. See Activity 24, page 342.

Helping the slow learner

Division practice cards, similar to those described in Activity 5, page 332, may be used to help the children eliminate their individual difficulties with the division basic facts reviewed so far.

Another activity in which the children are helped to visualize the division basic facts they are not sure of is one in which they circle equal groups within a larger group. Activity 27, page 345, can be adapted for this purpose.

If the multiplication-division basic chart suggested for the pupils in Activity 24 has been made and is available in the classroom, show the slow learners how to use it to find any division facts they are not sure of. See suggestions on page 342.

60-65 Looking back

Lesson Briefs for this lesson are on pages 65-68.

Overview

The division basic facts for the 20 to 36 groups (dividends of 20 to 36) are reviewed in the same way that the facts for the 4 to 18 groups were in the preceding lesson. A picture shows each division basic fact, and groups are ringed to suggest separation or division into equal smaller groups.

Teaching the whole class

If you wish to inventory the children's knowledge of the basic facts developed in this lesson, the exercises at the bottom of pages 60, 61, 62, 63, 64, and 65 may be used for this purpose. If certain difficulties thus become apparent, you can emphasize the facts involved as you work through the lesson.

Page 60: The pictures and text on this page should be taught in much the same way as the pictures and text on pages 56-59.

Page 61: Use the same procedure for the pictures and text on this page.

Page 62: Use the same procedure in the work with this page.

Page 63: This page may be taught in the same way.

Page 64: Teach these basic facts in the same way.

Page 65: The facts on this page may be taught in the same way.

Exercises A to P may be used for both oral and written work. Then direct the children to write each fact in computational form and supply the answers.

When this page has been finished, the children will have reviewed all the division basic facts through the 36 group.

Some children will find it helpful if they can see the relationship between the division and multiplication basic facts. Tell them that knowing the related multiplication facts will help them remember the division basic facts.

Have a child demonstrate with objects the relationship between $12 \div 3 = 4$ and $4 \times 3 = 12$. Have him arrange 4 groups of 3 objects and move them together. Ask the children what fact he has demonstrated. Be sure they identify it as multiplication. Leave the 12 objects together and point out that they can be separated into groups of 3. Have a child do this, and let the other children see the result. Call on one of them to state the fact demonstrated, and make sure they all understand that this is a division fact. Ask another child to repeat the complete demonstration and ask the children to note that groups of 3 are involved in both situations. Have the equations written on the board and discuss what each numeral stands for. Be sure they understand that 3 is placed where it is because it represents the size of the groups, the 4 is placed where it is because it represents the number of groups, and 12 is placed where it is because it represents the total number of objects. Let children volunteer to demonstrate other related multiplication and division facts.

Providing for the able pupil

To see how well the division basic facts taught thus far have been understood, you may wish to have each pupil make a chart like the one illustrated below. Tell the children first to circle each of the numbers for which they have learned the division basic

facts (4 through 36 at this point). Then for each number they should write all the division basic facts they can think of. Keep the charts for later use when the facts through the 81 group have been taught, and then repeat the activity.

1	11	21	31	41	51	61	71	81
2	12	22	32	42	52	62	72	82
3	13	23	33	43	53	63	73	83
4	14	24	34	44	54	64	74	84
5	15	25	35	45	55	65	75	85
6	16	26	36	46	56	66	76	86
7	17	27	37	47	57	67	77	87
8	18	28	38	48	58	68	78	88
9	19	29	39	49	59	69	79	89
10	20	30	40	50	60	70	80	

If the work suggested in Activities 18, 19, 20, and 21 has been done for the division basic facts taught previously, the children should now extend the work to include the facts for the 20 to 36 groups.

Helping the slow learner

The "football game," described in Activity 25, may be adapted to help the children review the division basic facts. See page 343.

If Activities 5, 24, and 27 were used with the preceding division basic facts, extend the work now to include the facts for the 20 to 36 groups.

66-67 Using arithmetic

Lesson Briefs for this lesson are on pages 69-70.

Teaching the whole class

Before beginning these problems, you will want to make sure that the children recognize and understand a divisive situation. First have them act out some divisive situations. For example, ask 6 children to come to the front of the room. Tell them that you want them to act out a situation demonstrating the division basic fact $6 \div 2 = 3$. The 6 children might walk to the back of the room or go to the board in groups of two. As another example, you could place 10 books on the table and ask a pupil to use them in showing the class the basic fact $10 \div 2 = 5$.

You can also let several pupils think of divisive situations and use objects found in the room to demonstrate them. When a demonstration has been completed, have someone write the proper equation on the board.

Page 66: Tell the children to read Problem A. Then have them describe what is happening in Picture A. [The children should see that Ann is arranging the 15 toys in groups of 3.] Be sure they notice the stack of boxes at the right, into which the toys are to be put in groups of three.

The paragraph labeled THINK should be read by the class to help them make the transition from the number of groups to the number of boxes needed. Then have a pupil write the complete equation on the chalkboard and explain what each numeral stands for.

Work through Problem B in much the same way. Help the pupils see that in Picture B, Tom has begun to put his pennies in groups of 5. Then, with the aid of the study hint, help them make the transition from number of groups of coins to number of apples. If coins and objects are available, you may wish to ask a child to demonstrate the action before the class.

Discuss Problem C and help pupils see why the equation $16 \div 8 = 2$ solves the problem. The action involved in this problem may also be demonstrated by a child, if you wish.

Assign the remaining problems on this page as written work. Tell pupils to write an equation (using a screen or square) for each problem. Then they may either rewrite the equation, putting the answer in place of the screen, or write just the answer in the square.

Page 67: Have pupils continue to solve these problems in the same way as they did those on the preceding page. The Expanded Notes for pages 28 and 29 on pages 250-251 give suggestions for correcting the work and ways of handling class discussion on difficult problems.

Providing for the able pupil

Division problems cut from old textbooks and pasted on 3″ x 5″ cards may be used to give pupils more experience in making equations and solving division problems. Be sure the problems do not exceed the range of the basic facts taught so far. Also be sure they are of the quotitive or "measurement" type. Activity 13, page 337, gives complete details.

Helping the slow learner

You may also give these pupils division equations

and ask them to make up and solve problems that fit the equations. Give each pupil a collection of objects and as many of the division problems on cards (described above) as you think he can handle without discouragement. Tell him to show the action indicated in each problem by manipulating the objects and then write the proper equation on his paper.

67 Checking up

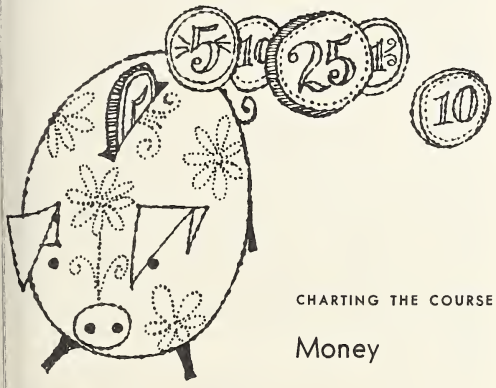
Lesson Briefs for this lessan are an pages 70-71.

Expanded Notes are not considered necessary for this lesson. See the suggestions in the Expanded Notes for page 17, pages 244-245.

68-69 Using arithmetic; Keeping skillful

Lesson Briefs for these lessans are on pages 71-73.

Expanded Notes are not considered necessary for these lessons.



CHARTING THE COURSE

Money

Among the applications of arithmetic to the practical affairs of daily living, few are more important than those that involve money. Arithmetic programs in the schools are expected to help children secure the knowledge about money that is necessary for solving these practical problems. *Seeing Through Arithmetic 4* provides carefully planned learning experiences for this purpose. These include lessons on counting money, writing amounts of money, and making change. Also included are lessons on the addition, subtraction, multiplication, and division of numbers that represent amounts of money.

Seeing Through Arithmetic 4 does not use presumed knowledge of the money system as an aid to learning either the number system or techniques of computing, such as carrying in addition. Instead, the number system is considered fundamental, and the learning of the money system is based on it.

The monetary system, while based upon the number system, has several complications of its own. The money system has coins for one cent (penny), ten cents (dime), and one hundred cents (dollar), and also bills for one dollar, ten dollars, one hundred dollars, one thousand dollars, and ten thousand dollars. These correspond to the important groupings in the number system. However, the money system also has intermediate coins for five cents (nickel), twenty-five cents (quarter), and fifty cents (half dollar); and it has five-dollar, fifty-dollar, five-hundred-dollar, and five-thousand-dollar bills. An additional complication is the provision of bills for two dollars and twenty dollars. These intermediate denominations do not correspond to the important groupings in the number system.

In *Seeing Through Arithmetic 4* the conventional ways of dealing with money are carefully developed. For example, in counting money it is customary to begin with the coin or bill representing the largest amount. In making change, it is customary to name first the amount being taken out (the cost of the article), and then to count upward with pennies, larger coins, and bills until the amount that was offered is reached. Children need experiences of this kind if they are to understand financial transactions in which they participate almost daily. Most children have frequent experiences of running errands that involve the handling of money.

Another complication arises in teaching the monetary system because children are expected to understand it, to write amounts of money, and to compute with dollars and cents before they have learned about decimal fractions. Real understanding is, therefore, necessarily limited until children have become familiar with decimal fractions. Until then an amount such as $1.32 can be understood as one dollar and 32 cents, but not as one and 32 one-hundredths dollars. Nevertheless, children can learn that by thinking of this amount as 132 cents, it can, for example, be added to a similar amount by the methods used for whole numbers, regardless of what they stand for in concrete situations. In brief, all numbers representing amounts of money are processed by the methods used with whole numbers. Then special attention is given to the interpretation of the answer in terms of dollars and cents.

70-73 Looking back

Lesson Briefs for this lesson are on pages 73-76.

Overview

In this lesson children review equivalent values for coins and study the use of paper money. They review the organization of currency into groups for counting and practice commonly used methods of counting money.

Most fourth-graders will be familiar with the appearance and names of the coins. It will be wise, then, to place the major emphasis on a knowledge of the equivalents and the use of these equivalents in counting money.

Reproductions of real coins (except for the penny) are shown in actual size on page 70. Below each reproduction, equivalents of the coin are shown in play money. Three ways of writing the amount of money represented by each coin are given. (The use of the dollar sign and point is not reviewed until the following lesson on pages 74-75.)

Exercises A to N at the top of page 71 provide practice in stating equivalents for specified coins, while Exercises A to R at the bottom of the page extend work with equivalents to include mixed denominations. The pictures on this page provide practice on counting procedures with coins. Counting procedures involving more complicated amounts are practiced by pupils on page 72.

Page 73 presents stylized pictures of some of the paper money in common use. On this page sums in excess of one dollar are organized in groups for counting, and pupils practice counting such sums.

Since government regulations prohibit the reproduction of paper money, it will be helpful to have a few real bills in some of the smaller denominations to pass around the class. As an alternative, you may project pictures of real money on a screen so the children may compare the different denominations. A supply of play money, to represent the various coins and bills up to fifty dollars, will be very useful. This money can be made by the children from oaktag or different colors of construction paper. They can make coins and bills in actual size and label each with the correct amount. Play money from various games can also be used.

Teaching the whole class

Page 70: Let the children discuss ways in which they have earned money, amounts they have earned, and what they did with it. Ask if any of them put their money into banks at home, and how they know exactly how much they have in their banks. Then have the statement at the top of page 70 read.

Ask someone to identify the coin in Picture A and have him read the text beside the coin. Ask the class what other pieces of money might be used that together would be worth just as much as a nickel, and direct attention to Picture B, which shows the penny equivalents for a nickel. Work in the same way with Pictures C, D, and E. Here let the children discover another combination, not pictured, that equals 10¢ (a nickel and 5 pennies). Discuss Pictures F to S in a similar manner. In each case let the children discover other coin combinations, not pictured, which would equal the amount of the coin under discussion.

A flannel board (see Activity 4, page 331, for directions) may be used here. Make simulated coins of oaktag backed with sandpaper. Hold up some item that could be bought for a nickel, such as a pencil, and let a child place on the flannel board the coin or coins he would use in buying this article. Other articles that could be bought for a dime, a quarter, a half dollar, or a dollar may be held up and the different coins in as many arrangements as possible placed on the flannel board by the children. The children may also be asked to draw each of the coins studied, being careful to maintain relative sizes, and then to match each coin with its equivalents in play money.

Page 71: The children may use the pictures on page 70 to help them find the answers to Exercises A to N and A to R on page 71. Let pupils take turns reading the exercises, supplying the missing quantities. If you wish to use Exercises A to N as written work, the children may write the letters of the exercises and opposite each one write the letter of the picture on page 70 that matches it. For example, opposite A (for Exercise A) they would write M (for Picture M).

Next draw attention to Picture A. Explain why the 2 overlapped nickels are usually counted as 1 ten. Explain that we count "ten" for the 10 cents and another "ten" (instead of "five and five") when we have 2 nickels because we can speed up our counting in this way.

You may want to point out the difference between counting coins and counting other objects. For example, beads might be counted by twos, threes, or fours, but coins are counted only by the number of pennies they stand for—one, five, ten, twenty-five or fifty.

Discuss how money is arranged for counting: like coins are grouped, the largest denominations are counted first, and convenient equivalents are used whenever possible ("20 cents" for 2 dimes, for example). Explain that in counting money it is no

necessary to say "cents" until the entire amount has been counted. Let the children take turns counting the money in Pictures A to G. If you wish, you can relate the pictures to some imagined real-life situation (for example, Picture A shows how much money Mary has in her pocketbook, etc.).

As an additional activity, the children might arrange collections of play money for counting. They may also use the flannel board to show how they would organize coins into groups for counting. Circles representing coins can be cut from flannel or felt.

Page 72: Let pupils study Pictures A and B, where some help has been given in counting the money, before going on to Pictures C to S. When they are ready, have them copy the letters C to S on their papers, and then write opposite the appropriate letters the numbers to say when counting the money in the pictures. The slower pupils may need to work through the page orally before undertaking written work.

Page 73: Before beginning the work on this page, show the children a few real bills of various denominations. If you have access to an opaque projector, it will provide an easy method of getting these bills before the class for study and comparison. You will need two bills of each denomination, since both sides should be studied at the same time. If you are unable to use a projector, masking tape may be used to fasten the money to a large piece of cardboard, which can be handled by the children. If the tape is carefully applied to the edges of the bills, it will not damage them. Encourage pupils to notice differences among the various denominations and also the difference between one side of a bill and the other side. Let the children discover that each bill carries an individual serial number. Have them find the places where the denomination is marked on each bill and notice whose picture appears on the front of the bill. If there is time, you might take the class on an imaginary trip to the Bureau of Engraving and Printing in Washington, D. C., and discuss how money is made and printed. Explain that because it is against the law to reproduce paper money realistically, the pictures on page 73 show play money.

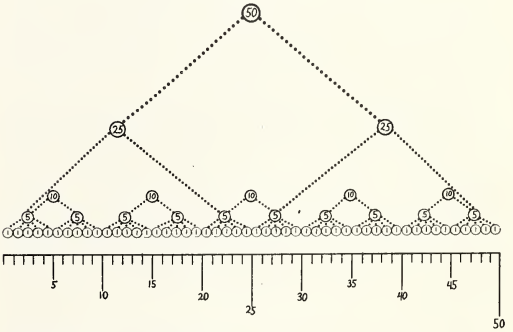
Review the method of organizing money for counting, and then have the children take turns counting aloud the money in the pictures. You may also have each child write the numbers he would say in counting each amount of money.

You could also let the children make a supply of simulated paper money in denominations of one, two, five, ten, twenty, and fifty, for use with their play coins in arranging and counting.

Providing for the able pupil

Able pupils might like to make special reports to the class or prepare dramatizations on topics such as "The History of Money," "Why We Have Money," etc. Pages 60-65 of the book *How Much and How Many* (see Activity 2, page 331) will give some helpful information, as will various encyclopedias.

An additional activity could be the preparation of a chart such as the one illustrated below, showing the equivalent values of the coins through 50¢. The chart will be convenient for reference if it is kept on display in the classroom. It should be made clear to the pupils that each triangle on the chart shows how many coins of a particular denomination are equal to a larger coin. The number line for counting coins that appears below the chart is an abstract rendering of the information displayed in concrete form on the chart itself. Able pupils should be encouraged to use the number line when counting coins.


50
25
25
10
10
10
10
10
10
10
5
5
5

another way to write this amount, using numerals and signs. Let a pupil write "$1 and 87¢" on the board, just as it appears in the book. Then tell him to erase the "and" and the cent sign. Ask someone to volunteer to read the result, which now appears as $187. Point out that if we want to show the amount that appears in the picture, we must have some way to show which figures stand for dollars and which figures stand for cents. Explain that we do this by putting a point between the numerals that tell how many dollars there are and the numerals that tell how many cents there are. Ask a child to put a point between the numerals on the board, so that the amount will appear as $1.87. Explain that this expression is also read "One dollar and eighty-seven cents." Point out that we have more ways of writing this amount than of reading it.

You might then say something like this:

You know that the point always comes after *the number of dollars. The point always comes* before *what? Can anyone write 87¢ on the board, using a point and dollar sign? If we write an amount that contains only cents, using a point and dollar sign, do we need to use the cent sign?*

Emphasize that the point, used with a dollar sign, is a signal that means "the two numbers that follow will mean cents." Also stress the fact that in *reading* an amount of money, we use the word "and" to stand for the point (or the break between dollars and cents) but that we also *say* "cents." Try to reserve the use of "and" to express the point and, later on, to indicate decimal fractions or fractions in mixed numbers, such as "six *and* two thirds." Elsewhere the use of "and" in reading numbers should be avoided. For example, the number 187 should be read as "one eighty-seven" or "one hundred eighty-seven," not "one hundred and eighty-seven." But 1.87 is read as "one *and* eighty-seven hundredths."

Page 74: To introduce the work on page 74, ask the children to think of the absolutely necessary things they would have to be able to do in order to be successful storekeepers. Bring out that they would need to write amounts of money, count money, and make change, and that all these things would have to be done accurately and fairly rapidly. Have the statement at the top of page 74 read. Direct attention to Picture A, and ask the children to count the money, starting with the bills. Call attention to the text and let the class discover that here are shown two ways to express this amount of money—in words and with numerals and signs. Let someone show on the chalkboard all the ways an amount of money that contains only dollars might be written (eleven dollars, 11 dollars, $11, $11.00). Let another pupil show all the ways an amount of money that contains only cents might be written (thirty-two cents, 32 cents, 32¢, $.32). You might then say:

Suppose we want to express the amount "eleven hundred thirty-two dollars." What should we put on the board in numerals and signs?

Then, after this amount has been written, you might ask a pupil to write $11.32 below it. Let a pupil explain why we know the latter amount is to be read as "eleven dollars and thirty-two cents" and not "eleven hundred thirty-two dollars."

Discuss Pictures B to E in the same detailed way. Make sure that everyone understands these two ideas: that there always must be two numerals after a point; and that if the number of cents to be expressed contains only one numeral, a zero must be written between it and the point, as shown in Pictures B and E.

Have the children count the money in Pictures F to Q (L to Q are on page 75) and write the amounts on their papers. You may need to remind them that amounts of dollars only or of cents only may be written with numerals and signs in two ways, and you may require them to write each such amount in the two ways.

Page 75: When the children have completed work on the pictures, have each child write the labeling letters for the first block of exercises (A to R) in a column and then write each amount, using numerals and signs, after its identifying letter. Explain that if there is more than one way to express an amount using numerals and signs, both ways are to be shown. Then let the children take turns reading the amounts shown in the last two blocks of exercises (A to R).

To conclude the lesson, ask a pupil to explain what he has learned, and then call on someone to read the statement at the bottom of the page.

Providing for the able pupil

Able pupils might like to make a chart to be displayed in the room. The chart would be called "How We Write Money" and would show all the ways there are of expressing amounts made up of dollars and cents, amounts made up of dollars only, and amounts made up of cents only.

Another activity they might like is that of drawing various combinations of currency that will make up the amounts shown in the exercises on page 75. For example, nineteen dollars and five cents might be made up of 3 five-dollar bills, 4 one-dollar bills, and a nickel, or it might be made up of 1 ten-dollar bill, 9 one-dollar bills, and 5 pennies, etc. If these combinations are drawn on cards, they can be used later

with the slower pupils. Assign one or two exercises to each child and have each one find as many possible combinations as he can.

Helping the slow learner

Slower pupils could use the money cards drawn by the able students for practice in identifying the amounts represented. Help them make the generalization that the larger the amount of money, the more ways it can be shown.

76-78 Looking back

Lesson Briefs for this lesson are on pages 78-80.

Overview

Children review what they have previously learned about making change and gain further experience with money equivalents by making change themselves.

If the children are not already provided with a supply of play money (both coins and bills), you will need to see that each child has 9 pennies, 5 dimes, 5 nickels, 3 quarters, 2 fifty-cent pieces, 4 one-dollar bills, and 1 five-dollar bill. The children can make simulated coins and bills, as was suggested in the Expanded Notes for pages 70-73.

In previous lessons on counting money, children learned to organize currency into groups of like denominations, to start counting with the highest denomination, and to continue with the next highest, ending with the smallest denomination. When making change, children must learn to start with the price of the article, and to select first the coins that will bring the money being counted to a convenient amount from which to continue the counting operation. (Convenient amounts are those ending in a five or a zero, such as $.05, $.10, $.15, $.20, $.25, etc.) A brief review of counting by 5's, 10's, and 25's might be helpful.

The pictures on pages 76 and 77 show the commonly used method of counting change. Pictures A to C on page 76 show the article purchased, together with its price and the money given to pay for it; the accompanying pictures show how the change is counted and what is said aloud each time a new coin is given.

The pictures on page 77 show the article purchased, the price, the money given to pay for it, and the coins given in change. The children are not told what to say as they make change. For the problems on page 78, the children are to make change without the help of pictures except for the first three.

Children should understand that the coins shown as being given in change on pages 76 and 77 are not the only coins that could be used. For example, in Picture B on page 77, a half dollar might have been given in place of the two quarters; while in Picture C, the change given might have been two pennies, a nickel, and a quarter. The children will discover, through actual practice, that once the convenient amount from which to continue the change-making has been reached, the balance of the change can be made up in a variety of ways. The number of variations, of course, depends upon the coins they have to work with.

Teaching the whole class

If you know the children already have a good understanding of money and have had some experience in change-making, you may wish to begin at once with the work in the book. However, with most groups, it might be wise to give the children an opportunity to talk about money and how it is used.

Page 76: Direct attention to the first scene of Movie A. Explain that the price of the fire engine is 54¢ and that a boy has given the clerk three quarters to pay for it. Let the children say what the total amount is. Tell them that the following three scenes of the movie show what coins the clerk will give the boy in change and what she will say as she counts the change. First she says "54" (the purchase price). Then she puts down a penny and says "55." Now she has reached a convenient amount from which to continue counting by 5's, 10's, or 25's. Next she puts down a dime and says "65." The penny is dimmed off in this scene because the customer already has it, and neither he nor the clerk has to think of it any more. In the final scene, the clerk puts down another dime and says "75 cents," which is the amount the customer gave her.

Explain that in counting change, the words "cents" and "dollars" are not used until the operation of making change has been completed. In this scene the penny and the first dime are dimmed off because they already have been counted. Work through Movies B and C with the children, getting them to state, first, the purchase price and the amount given in payment. They should then identify each coin and bill given in change and explain why these coins and bills are correct in the situation. Some of the children may be able to suggest other ways of making change. They should be allowed to do so, but make sure that the slower pupils do not become confused by too many alternatives.

Page 77: First work through each of these pictures orally with the children. Have them state, for each picture, the purchase price and the amount given in payment; then let them count the change, using the

coins in the picture as a guide. Note that some help is provided in Picture A.

Page 78: Before the children attempt the work on this page, you may wish to use the following activity.

Arrange any articles available in the classroom (a pen, a box of crayons, a notebook) on a table and place a card with the price next to each article. Then, after seeing that the children are provided with play money, let them "buy" and "sell" the articles. Say:

You are buying a tablet that costs 15¢. You give the clerk a quarter. What change will the clerk give you? Let's act out the situation.

Let a child pretend he is the clerk. Have him select the amount of money he needs from his play money and hand it to another child with the tablet, saying: "15, 25¢." This action could be dramatized by three children—one acting as the buyer, one as the seller, and one as a "checker" to see that the proper change is given and that it is counted correctly. Then the roles could be exchanged, until each child has had an opportunity to play each part once. This activity may be continued as long as interest is maintained. Articles "sold" should vary in price, and varying amounts of money should be offered in payment. Then have the children do the work on this page independently, following the directions at the top of the page.

Providing for the able pupil

Use different amounts for the money offered in payment for the articles in Problems A to Q on page 78, and let able students show in how many ways change for the various articles purchased can be made up. For example, for Problem A change $1 to $5, for Problem B change $5 to $10, etc.

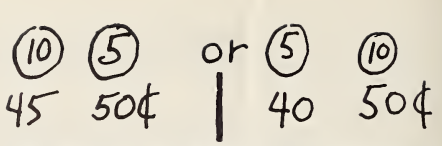
Activity 29, page 346, provides practice in making change for $10.

Helping the slow learner

Activity 31, described on page 348, will give slow learners practice in simple change-making situations. You might also simplify some of the lesson problems by adjusting them in such a way that there is only a small difference between the purchase price and the amount used to make the purchase.

Direct pupils to make change problems about toys and then show how they would make change by using toy money or by drawing circles for coins and writing under them the numbers they would say. Given (below) are a sample problem and (at the top of the next column) sample drawings for the problem.

"Carol bought a 35¢ toy. She gave the clerk 2 quarters. Show one way the clerk might have given back the change."



Slow learners may also be helped by referring to the number line for counting coins. See "Providing for the able student," page 268.

79 Thinking straight; Keeping skillful

Lesson Briefs for these lessons are on page 81.

Expanded Notes are not considered necessary for these lessons.

80-81 Learning how

Lesson Briefs for this lesson are on pages 82-83.

Overview

Most fourth-graders are beginning to understand the value of money and are greatly interested in earning some of their own. Their many projects often require a certain amount of "ready cash," and they are on the lookout for ways of earning money. They find many occasions in and out of school for adding amounts of money. They should be helped to see that in adding money, the computation is performed exactly as if they were dealing with whole numbers. The only new thing is the inclusion of the point and the substitution of the dollar sign for the cents' sign. They need to understand that 161 cents is the same as $1.00 and 61 cents, and that it may be written $1.61. Pupils should become aware of the importance of keeping the points in a line in column addition, as well as the correct placement of the dollar sign.

Following the SEE and THINK examples of the four-step teaching method used on pages 80 and 81 are opportunities for the children to TRY and DO similar exercises in writing and adding amounts of money. The last block of exercises (A to I) on page 81 are provided for those pupils who seem to need more practice.

Children should learn that correct vertical placement of numerals is important in column addition, and particularly in adding dollars and cents. A good understanding of the number system will enable them to understand why this is so. Difficulties with this lesson may stem from careless placement of the numerals in writing them in columns.

Teaching the whole class

Before the children open their books, there should be a class discussion to tie in this new lesson on

adding dollars and cents with the last several lessons on counting and writing different amounts of money. Then an everyday situation may be described, such as one that arises when a child receives money from several sources (birthday gifts, earnings, allowance) and wants to add the amounts to see how much he has. Children are usually enthusiastic about volunteering to tell about such instances.

Page 80: After the children have read the problem, let them identify in Picture A the three amounts mentioned in the problem. Then ask:

How can we find out how much money Jim had when he put his three weeks' earnings all together?

Discuss the addition equation and have a child explain why it is correct. Then have the pupils look at the computational form. Ask someone to verify the sum. Make sure the class understands that the 161 means 161¢.

Next have the class read the first three lines after the letter B and examine the computational form with the dollar signs and points. Let someone read the two sentences opposite the computation. Ask everyone to do the addition, and then call on a pupil to read the sentence with the arrow pointing to the answer. Let someone read the last sentence and the equation and then count the money pictured at the left. See that the overlapped nickels are counted as tens. Make sure the children realize that the coins that were in Picture A are also in Picture B, but that they have been rearranged for easy counting to show that there is one dollar and 61 cents. Children should also realize that the dollar sign is used in two places only when computing—with the first amount and with the answer.

Page 81: This THINK step of the four-step teaching method may be handled orally. After a pupil has read the problem aloud, discuss and verify the equation. Then have pupils read and answer the questions after the computational form. Ask someone to do the addition orally. Finish by having someone read the last sentence and the equation, supplying the answers.

Then tell the children to try to solve the problem and examples in the TRY step. They may verify their answers with the worked-out examples in green.

Help any of the children who seem to be in need of assistance. The children who finish the work in the TRY step without difficulty should go on to the DO step and work the first block of exercises (A to Q). Explain that here they must put the amounts of money in computational form, and that even if the money is written with the cents' sign in the book, they are to write it with the dollar sign and point. Remind them that in the computational form the dollar sign is only used twice—with the first amount in the column of figures and with the answer. The slower children may need more help. Exercises A to I may be used as extra work for those who need it.

Providing for the able pupil

Family shopping can give the able pupils many opportunities to add dollars and cents. For example, ask these children to bring to school cash register slips for the family groceries. Then ask them to check the totals by re-adding. If there are so many items that it is hard to find the total, ask the pupils to find the cost of the first four or five items. Some pupils, of course, will enjoy trying to add long columns of figures.

Children enjoy leafing through seed catalogs, toy catalogs, and mail-order catalogs. Let them make out imaginary orders and total the bill. Each child, for example, may like to pick out a complete wardrobe. The girls can order furniture and household appliances, while the boys choose tools to outfit a home workshop. They all may enjoy ordering seeds, plants, and bushes for spring gardens.

There are often occasions when amounts of money connected with pupils' lunches, milk, etc., need to be added. Able children may take over this job.

The children may make savings bankbooks, and write in imaginary deposits. If this is done, be sure to explain to the children why it is unnecessary to use the point (the cents are separated from the dollars by a line). The children may then total their imaginary deposits.

Helping the slow learner

A small group of children seated around a table may participate in adding amounts of real or play money. Have them take turns arranging the money into three groups of different amounts. Then have them write the amounts and add the column.

Another activity for these children uses pictures of articles with price marks cut from newspapers. The children may paste these pictures on large pieces of newsprint. Or, if you prefer, sets of pictures, classified as to the type of store in which the articles could be bought, may be kept in separate envelopes. Then, working in small groups, pupils may play store, writing down the articles purchased and their prices. These prices should then be totaled. This play will be more realistic and absorbing if you can obtain several pads of sales slips for the children to use. Most of these slips have carbons, the use of which adds to the motivation.

Remind the children always to write their columns so that the points are lined up. They may verify

their addition by using play money, if it is available. They may also make such common-sense evaluations as: "To add $1.10, $.89, and $.63, I think: $1.10 is about $1.00; $1.00 plus $.89 is about $2.00; $2.00 plus $.63 is about $2.60."

82-83 Learning how

Lesson Briefs for this lesson are on pages 83-84.

Overview

In this lesson, children will apply previously learned skills in subtraction to problems and examples involving dollars and cents, while continuing to practice the correct use of the point and the dollar sign. Guide their activities through the SEE and THINK steps and then let them work independently in the TRY and DO parts.

Teaching the whole class

Before the children open their books, there should be a class discussion in which the usefulness of skill in subtracting amounts of money is highlighted. The children have learned to make change by counting, but you should point out that there are times when they will need to subtract amounts of money. Say:

Do you have a bank at home? Tell us about it. Do you keep track of the amount of money in it? Do you ever take out any of the money? How do you find out what is left?

The children may now be able to suggest problems from their own experience in which they had to subtract one amount of money from another.

Page 82: Tell the children that the two dollar bills they see at the top of this page belong to John. He wants to buy something, but it will not take all his money. Ask them to read the problem to find out what he plans to buy and how much it will cost. Then ask them to look at Pictures A to D. Let a pupil describe what he sees in Picture A and tell what has happened in Picture B. Lead him to see that one of the dollar bills has been changed to coins so that one dollar and thirty-five cents can be taken away. Ask another pupil to explain what Pictures C and D show.

If play money is available, tell the children to use two of their toy dollar bills and change one into the same coins that John did. Then ask them to perform the action shown in the pictures.

Next ask the children to look at the equation under the problem. Let someone tell why it is correct. Then have a pupil write the money John had and the amount he spent in computational form on the chalkboard in readiness for subtraction. Remind him that, just as in addition, he must keep the points lined up and use the dollar sign with the first amount and with the answer when it is found. Have him compare his work with that in the book. Then tell him to subtract just as he always does. Let the class compare the work on the chalkboard with the computation in the book. Also have the children count the coins in Picture D to see if the amount matches that found through subtraction. Call on a pupil to read the last sentence and the equation.

Page 83: You might continue the lesson by reminding the children that some people save money in banks at home. Say:

Some of them save quite a lot of money. Read the problem at the top of page 83. How much had Mary saved? What did she plan to buy? How much did the paper dolls cost? How could Mary find out how much money she had left in her bank?

Call on a pupil to read the equation and to explain it. Then ask a pupil to answer the two questions about the computation. Remind the children that the only thing that is different about this example is the placement of the points and dollar signs.

For the work in the TRY step, have the children write the computation on their papers. Point out that although the amounts of money in Problem A are given with the cents' sign, the dollar sign and the point are used in the computation. Tell the children to cover the work in green until they have finished their computation. Then they can use it to verify their work. Be sure they understand why it is necessary to write a zero in the answer. Also tell the children that when they feel they understand these examples, they may go on and do the work in the first block of exercises (A to S) in the DO step.

Exercises A to J, in the last block of work, should be assigned to those who seem to need more practice.

Providing for the able pupil

As one activity, you might give each child an envelope in which are several slips of paper with different amounts written on them. The children can pretend that these slips are checks received for birthday or Christmas gifts. Provide oaktag cards on which are mounted pictures of toys, clothing, tools, pets, or other desirable things a fourth-grader might like to buy, each with its price. (The cards made for Activity 28, page 346, may be used here.) As an alternative, children may choose from catalogs or newspapers items that they would like to purchase. Ask them to pretend to buy one gift out of each "check" and then compute to see how much money they will have left out of each "check." Tell them to write each problem on their paper before they do the computation. (For example: "I have $5.00. The doll costs $3.98.

How much will I have left from my check after I buy the doll?")

If the children used savings bankbooks and wrote imaginary deposits for totaling, as was suggested in the previous lesson, they may now use the bankbooks for a subtraction activity. Tell them to pretend to withdraw various amounts for different purposes, subtracting each time to determine how much is left.

If the newspaper advertisements suggested in Activity 29, page 346 (ads of sales with original price and sale price given) are available, you can now have the children find by subtraction the amount saved by buying the article on sale instead of at its original price.

Helping the slow learner

Let these children cut out pictures of food and paste the pictures on a long, narrow strip of oaktag to represent the food in the school cafeteria. If you wish, lists of foods may be made instead. Label each picture with its price. Each child may then select the foods he wants for lunch, writing down the amounts in a column on his paper and adding to find the total. Each one should have a certain amount of play money, agreed upon in advance. From this amount he should pay his bill and determine, by arranging his money on his desk, what he has left. He should then write under his addition computation the amount he had to begin with and the amount he spent and subtract to find what he has left. The coins he has left and the answer should be the same. If he has any difficulties, these should be diagnosed, and as much help as necessary given through the use of real or play coins, dramatizations, and review of ordinary subtraction.

84 Using arithmetic

Lesson Briefs for this lesson are on pages 85-86.

Expanded Notes are not considered necessary for this lesson.

84 Checking up

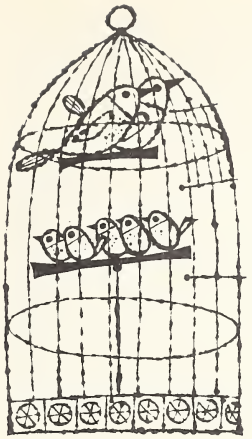
Lesson Briefs for this lesson are on page 86.

Expanded Notes are not considered necessary for this lesson.

85 Keeping skillful

Lesson Briefs for this lesson are on page 87.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Problems involving subtraction

The simplest problem situations in arithmetic involve an action (real or imagined) that is additive, subtractive, multiplicative, or divisive. All problem situations may be analyzed in terms of one of these four fundamental types. Up to this point problem situations in *Seeing Through Arithmetic 4* have been restricted not only to those of the simplest types, but also to the simplest cases of those types. Attention must now be given to the analysis of certain other types of problem situations. Pupils who have not been previously introduced to three important types of problems by the methods of this program are provided with full explanations on pages 86-94. These pages provide materials for a complete reteaching of these types for children who have studied them in earlier books of this arithmetic program.*

First to be considered are situations in which two different groups of known size are to be compared. The question is: The larger group contains how many more objects than the smaller? Or, alternatively, the smaller group contains how many fewer objects than the larger? No action is immediately evident in a situation of this kind. The mode of attack is, first, to match or pair objects in the two groups until all the objects in the smaller group have been used. The members of the larger group that are thus matched may then be imagined as set aside, and attention may be focused

Numbers in Action, by Maurice L. Hartung, Henry Van Engen, and Catharine Mahaney. Scatt, Faresman and Company.

Seeing Through Arithmetic 3, by Maurice L. Hartung, Henry Van Engen, Lais Knowles, and Catharine Mahaney. Scatt, Faresman and Company.

on the remainder. This imagined setting aside of a part of a group suggests the use of the process of subtraction in solving the problem with number symbols. An explanation along these lines is given on pages 86 and 87 of *Seeing Through Arithmetic 4.*

A second type of problem situation to be reviewed is one in which a group of unknown size is added to a group of known size to produce a new group whose size is also known. This situation is additive but cannot be solved directly by addition because one of the numbers to be added is not known. For example, suppose the problem is as follows: "Bill had 11 model cars. He bought some more cars at the toy store. Then he had 14 model cars. How many model cars did he buy at the toy store?" Children should recognize this as an additive situation and should learn to write the equation $11+\square=14$ to represent it. Attention may then be directed to finding the missing number in this equation. Pictures in the book show that a group of 11 has been set aside, and this should make clear that the answer is found by subtraction. An explanation of this situation is given on pages 88 and 89.

A third type of situation to be reviewed is one in which a group of known size is added to a group of unknown size to produce a new group whose size is also known. This situation is also additive and is quite similar to the one discussed above. In this case, however, when the situation is expressed in arithmetical symbols, an equation like $\square+15=41$ is obtained. In the book, pictures show that a group of 15 has been set aside, which suggests that the process of subtracting 15 from 41 will give the answer to the original problem. An explanation of such situations is given on pages 92 and 93.

Finally, problem solving often requires the use of certain special skills. Among these are the ability to round off numbers, to use approximations, and to compute mentally by a variety of "short cuts." Children who understand the number system can devise various special methods of computing of their own. They need, however, to have their attention called to the variety of possibilities as to ways of obtaining an answer mentally. Learning experiences for these general purposes are provided by pages 97-100 of *Seeing Through Arithmetic 4.*

It is not to be expected that all children will quickly become expert in mental arithmetic. On the other hand, it is certain that few pupils will use such methods without being taught how to do so.

86-87 Exploring problems

Lesson Briefs for this lesson ore on poges 88-89.

Overview

So far four problem situations have been reviewed—those involving additive situations (finding the sum), subtractive situations (finding how many are left), multiplicative situations (finding the product), and divisive situations (finding the number of equal groups). In this lesson another problem situation is retaught—finding how many more (or fewer) there are in one group than another. This comparative situation is usually classified as a subtraction problem because it is solved by subtraction.

From now on in this book new types of problem situations and how to solve them will be presented under a heading entitled "Exploring problems." The pictorial material illustrating the problem situation and showing the child how to make the equation is labeled "See." The computation necessary for finding the missing number in the equation is labeled "Compute."

Note that in Picture C (page 86), which illustrates how the equation is obtained, the objects to be imagined as gone are dimmed off. It is important in this connection that the children understand that the group imagined as removed is equal to the smaller group of objects being compared.

Page 87 provides problems to solve. Although most of them are of the new type of problem situation, previously studied problem situations are also included. This has been done not only for review purposes but also to make sure that pupils read the problems and interpret them, instead of using the same type of equation over and over again without giving any thought to the meaning.

Teaching the whole class

Page 86: Before beginning the work in the book, it will be well to review the subtractive situation (how many are left) that the children already know. Ask the children to make up simple problems, each involving a subtractive situation in which part of a group is taken away from the whole group. Select one of the children's problems, and ask another pupil to go to the board, write the equation with a screen or square, and then do any computation that may be necessary to find the answer. Keep the work on the board, and tell the children that they are going to study a different kind of problem situation that is solved in much the same way.

Next ask the children to open their books to page 86. Ask if they have ever been to a fair or in a store where people were to try to guess the number

of pieces in a jar of beans or corn. Then let them try to guess the number of candy sticks and lollipops in the jars in Picture A. Tell them to read the problem, which will tell the number of lollipops and sticks of candy there are in the jars. Be sure they understand that they are not expected to give the answer to either of the questions in the problem until later. Explain that first they will find out how many more candy sticks were sold than lollipops.

Next have the children look at Picture B. Lead them to observe that all the lollipops have been taken out of the jar. Ask if they can tell from the picture that 32 lollipops were in the jar and are now outside of it. Lead them to note the arrangement of 3 tens and 2. Ask them if they can tell how many candy sticks have been taken out of the candy stick jar. Direct attention to the fact that there are still some candy sticks left in the jar. Then discuss the matching of sticks with lollipops in Picture B. Make sure pupils understand that the real problem now is to find how many of the 45 candy sticks are not matched with the lollipops. Have them look at Picture B again to see if they can think of a way to find how many candy sticks are left unmatched inside the jar.

Then call attention to Picture C. Work for the idea of removing the matched candy sticks. Direct attention to the dimming off of the 32 matched candy sticks and discuss what it suggests. Ask the children what removing part of a group should make them think of. Then call attention to the subtraction equation at the right. Discuss the equation and the explanations.

Ask someone to write the work in computational form on the board and subtract. When he has finished, have the class look at the computation at the bottom of the page in the book and discuss the first three lines.

Now have the children look back at the two questions asked in the problem opposite Picture A. Have them read aloud the sentences at the bottom of the page that answer these questions. Make sure the children see why the same solution can answer both questions. Tell them to look again at Picture C and notice that there are more candy sticks than lollipops. Also have them look at Picture C and notice that there are fewer lollipops than candy sticks. It would take 13 lollipops in the empty jar to match the candy sticks in the jar.

Point out, too, that the imagined subtraction took candy sticks away from candy sticks—not lollipops from candy sticks. Once the matching has been accomplished, no further attention need be paid to the smaller group in either the equation or the computation.

It will be well to work out a simple problem of this type for the class with objects. Let the children think of a problem situation using numbers under 20 so that the objects can easily be obtained. Then use the real objects or markers representing those in the problem. (Have these on hand before the lesson begins.) For example, a child's problem might be like this: "There are 18 pencils and 11 erasers. How many more pencils are there than erasers?" Collect 18 pencils and 11 erasers and put them in separate groups on the table in front of the class. Ask a child to come to the table and show what to do with the objects to solve the problem. He should line up the 18 pencils, and beside them line up the 11 erasers. Have him point out, then, the 11 pencils that match the 11 erasers. Ask him what he should do next. He should remove the 11 pencils from the whole group of 18 pencils. Let him count the number of pencils left, and ask him what this shows in terms of pencils, and, then, in terms of erasers. Then ask him to put on the board numerals to show what he did. He should first write the equation $18-11=\square$. Have him explain what each symbol (including the screen) stands for. Then have him rewrite these numerals in computational form for subtraction. The answer resulting from the computation should be the same as the remaining number of pencils that he counted before.

Repeat this type of activity as many times as necessary, and give different children turns at solving problems both with objects and then on the board by computation. In each case ask how many fewer there are in the smaller group compared with the larger group, as well as how many more there are in the larger group.

Page 87: Discuss Problem A, relating the equation to the problem. Let a child subtract 17 from 31 at the board to get the answer. Then have another pupil answer Problem B. Problems C and D may be treated orally, too.

Next assign Problems E to L as written work. Direct the children to write each equation with the screen or square, do the computation, and then either rewrite the equation with the answer, or, if they used the square, insert the answer inside this square in their equation. Remind the children that any computation involving money should be written with the dollar sign and point. Warn them, too, that not all the problems in the set are of the same type. Tell them that some of the problems are kinds they have met earlier and that they should think about each problem carefully to see what kind of an equation to make.

After the children have finished, the equations and answers may be verified in class. The problems that seemed to give the children trouble should be discussed. If the children did not make the right equation, let them substitute smaller numbers for those in the problem and use objects to show what happened in the problem. From such work they should see what kind of equation the problem calls for. If their computation is faulty, find out whether carelessness or lack of understanding of the process is the cause.

Providing for the able pupil

Write on the board some equations that stand for subtractive situations ($45-18=\square$, for example). Then ask the able pupils to write two different types of problems that fit each equation. They are to write the computation and find the answer to each problem they make up. This may be done on the back of the paper. The problem situations they describe should be those in which part of a group is taken from the whole group and those in which two groups are compared to find out how many more or fewer there are in one group than in another.

Helping the slow learner

Put two different groups of objects on a table (such as 5 pieces of chalk, 12 erasers; 15 corks, 11 jacks; etc.). Then let the children take turns making up problems, orally, about how many more or how many fewer there are in one group than in the other. When a child has made up a problem, let him call on someone else to use the objects, solve the problem, and then write on the board the equation and the computation necessary to find the answer.

88-90 Exploring problems

Lesson Briefs for this lesson are on pages 90-92.

Overview

Another type of problem situation—finding how many were added or how many more are needed—is presented in this lesson. Pictures show that the action of the problem situation is that of combining and that the resulting equation is the type in which the number to be added is missing ($11+\square=14$). Other pictures show why the process of subtraction can be used to solve the equation. The developmental material is presented in two parts. "See" shows how to get the equation, and "Compute" shows how subtraction solves the equation.

Teaching the whole class

Page 88: Since the first problem is about model cars, you might begin the lesson by asking the boys to tell about their collection of model cars. Then have the children open their books to page 88 and read Problem A silently. Tell the children to look at Picture A, which shows the 11 model cars Bill had at first. Explain that the large 11 at the right stands for these 11 cars. Go on somewhat like this:

Look at Picture B. What new thing does this picture show? What is being done with these new cars? When a group is put with another group, what sign do you write in the equation to show what is happening? Since we don't know how many new model cars are being put with the old ones, we have to put a screen after the plus sign.

Now look at Picture C. How many model cars are shown? Where did the extra cars come from? Does this number agree with that given in the problem? Now look at the equation beside Picture C. What has been written after the screen? What does it stand for?

Now we must use the numbers in the equation to compute to find the missing numbers. Should we add? Why not? Let's see if we can find out what we must do to get the missing number. Look at Picture D to see all of Bill's model cars again.

Page 89: Continue by asking questions similar to these:

What does the sentence opposite Picture E tell you to do? Does the ring around some of the cars in Picture E help you think about them? The large 11 also stands for the number of cars Bill had at first. Let's go on to Picture F. How does Picture F show that you should imagine the group of 11 cars as gone? Remember that the number left will show the number of new model cars Bill bought. Why does this picture make you think of subtracting?

Look at the computation. The 14 stands for all the model cars Bill has now. The 11 stands for the cars which you are imagining as gone. What is the answer when we subtract? Look at Picture F again. How many cars are in strong color? Read the equation and what is said about it. If you put the number 3 in place of the screen, is the complete equation correct? Does $11+3=14$? So Bill bought 3 new cars.

The new Problem A gives the children a chance to apply what they have just learned. This time the problem is of the "how many more are needed" type. Since no pictures are provided, it may help if you demonstrate the problem's solution by using pennies. First help the children build the equation. Then let a child show the subtractive action that will give the answer, and have him also write on the board the computation that shows this action.

For the remaining problems on this page, talk about the situations, and call on pupils to explain in each case why one number can be subtracted from the other to find the answer.

Page 90: Before the children begin the work, it may be well to dramatize several more problem situations of the additive type being taught in this lesson. For example, let one child take several objects and tell the class how many he has. Then give him some more objects. Ask him how many objects he has now and tell him that he is to find how many objects you gave him. Suggest that he put all his objects in a group on a table and see how many in all he has now. Help him to see that to find how many objects were given to him, he should remove a group of objects equal in number to those he had at first. Then the group that is left will be the number you gave him. Next help him to show in writing what he has done with the objects. First he should write the equation on the board to show the problem situation. Then he should write the numbers in correct computational form.

After the children have worked a few problems in this manner, assign Problems D to R as written work. Tell the pupils to read each problem silently and then write the equation with a screen or square for the missing number. Next they are to write the figures in computational form and compute to find the answer. Then they should either put the answer inside the square of the equation or rewrite it with the answer in place of the screen. Problems H, I, and J involve different kinds of problems. Some previously taught problem types are always included in each problem set so that the children will not fall into the habit of always making the same type of equation without thinking. When the children have completed the problems, go over all of them in class so that the children may verify their work.

Providing for the able pupil

An activity called "Magic Squares" gives practice in finding how many more are needed. It also gives practice in column addition. The objective is to fill in missing numbers so that the sum for each horizontal and vertical row will be the same.

To prepare for this activity, make cards for the children to copy on paper. Rule 4″ x 6″ cards into rectangles (four rows of four rectangles each). Numbers are written in some of these rectangles, and some of them are left blank. The numbers are to be arranged in such a way that when the blank rectangles are filled in by the children and added to the numbers given, the answers for every row will be the same, vertically as well as horizontally. It will be necessary to fill all the squares in one of the rows with numbers to show what the sum of each of the rows should be. Two sample cards that include one-figure and two-figure numbers are shown below. The top rows have been filled in here. The circled numbers are the numbers that should be omitted from the cards made for the child. These are the numbers he is to find and insert on his paper. Perhaps you will want to begin this activity with an easy magic square with only nine squares instead of sixteen.

13	9	10	15
(11)	16	(10)	10
16	(8)	(11)	12
(7)	14	16	(10)

7	3	9	7
8	(9)	5	(4)
(8)	5	(3)	10
3	(9)	(9)	5

To get the activity under way, tell the child to rule his paper like the card you gave him. (Be sure the circled numbers on the sample cards shown above are not included.) Tell him to write in the rectangles on his paper the same numbers as shown on his card.

Then have the child add all the numbers in the row that is filled in. Be sure he understands that the numbers in each row (down and across) should have the same sum as this one when he has filled in all of the rectangles. Suggest that he first find the sum of the three numbers in the rows that have only one number missing. Through discussion and questions help him to see that now he knows the sum of three numbers, and knows the sum of all four numbers, but he needs to find out what the fourth number is. He has a problem of the "how many more are needed" type, which can be solved by subtraction.

Another activity based on cards with a series of pictures showing articles, their prices, and coins will give independent practice in finding how much more is needed. See Activity 32, page 348.

Helping the slow learner

Children who have difficulty with the "how many were added" type of problem should be given opportunities to dramatize situations of this type. Small toys, such as toy autos, airplanes, blocks, etc., should be given them to work with. The children can work in pairs, a slow learner teamed with one of the abler pupils. The slow learner can select a number of the toys, and his partner can then give him some more, without letting him know how many. Then the first child should perform the actions necessary to find how many were added. The partner can verify his work.

The cards made for Activity 28, page 346 (objects to buy and their price) may be used here. Pupils may work in groups of three. Each group should select a card on which is pasted a picture of an article and its price. The children may pretend it is the birthday of one member of the group, and each should give him a small amount of play money. Warn them that the total of the money given should be less than the price of the article. Each child should then add these amounts given as gifts and use each other's totals to verify the addition. Since more money is needed to buy the article, they should next find out how much is needed.

91 Looking back

Lesson Briefs for this lesson are on pages 92-93.

Overview

In this lesson children learn how to change a unit of measure to a smaller unit or to a larger unit. They learn that this is done in the same way that multiplicative and divisive problem situations are solved. They learn why they should multiply to change a unit of measure to a smaller unit and why they should divide to change to a larger unit.

The first problem is concerned with changing a measure to a smaller unit (gallons to quarts), and an accompanying illustration shows that this is a case of finding the total when equal groups are combined (a multiplicative situation).

In the second problem smaller units are changed to larger units (pints to quarts). An accompanying illustration shows that here the problem requires the finding of the number of equal groups. Knowing that two pints are equal to one quart, pupils see the pints separated into groups of two and a quart matched to each group. Counting the number of groups gives the answer. They know also that such separating into equal groups is a divisive situation.

Other problems and exercises on the page provide further practice in changing measures. Children should not be required to make equations unless they show evidence of merely guessing in attempting to solve these problems and exercises.

Teaching the whole class

If any of the children know how syrup or molasses is made, let them tell the class about it. Then call attention to Problem A and have the first sentence labeled "Think" read aloud. Have the class look at Picture A. Point out that it shows that each gallon is equal to a group of 4 quarts. Have the second statement read. Ask how the picture shows that 2 gallons are equal to two groups of 4 quarts. Ask how many two groups of 4 are. Help the class determine that this is a multiplicative situation. Then have the equation read. Point out that this is just another way of saying two groups of 4. Let a pupil read the last statement, giving the missing number. To verify the answer, have another pupil count the number of quarts in the two groups shown in Picture A.

As an additional activity, have two children demonstrate with gallon and quart bottles (or oaktag replicas) the solution to this problem. After they have matched a group of 4 quarts to each gallon, they should combine the quarts and count the quarts in the total group. Ask one of them to write on the board the equation that shows how to solve this problem. Point out that in solving this problem they had to go from a larger unit of measure to a smaller unit.

Next ask pupils to read Problem B. Lead them to notice that they are going to change from a smaller unit of measure to a larger unit of measure. Ask

them if they can remember how many pints equal 1 quart. Then have a pupil read the first statement after the heading "Think." Tell pupils to look at Picture B to see that each group of 2 pints is equal to 1 quart. Tell pupils to use Picture B, too, to find the missing number in the second statement. Let someone read the equation and complete it. Help pupils to see that once they have found how many groups of 2 pints there are, it is only a matter of matching quarts to the number of groups to get the answer in quarts. Let someone finish this problem by reading the last sentence and supplying the missing number. Again have two children work this problem by using quart and pint containers (or replicas) to show what happens.

Discuss Problem C. Use a calendar to help the children get the idea of groups of 7 days.

The slower learners may need to use a yardstick and a foot ruler to solve Problem D. Ask for suggestions as to how to do this. One way would be to first mark off the 27 feet by placing the foot ruler on the floor 27 times and marking the end of it each time. Then help the children recall that 3 feet equal 1 yard. Let them use chalk of a different color to re-mark every third foot mark to indicate 3 feet or 1 yard. In that way they can see how many groups of 3 feet, or yards, there are. Lead them to see that to solve the problem they should count the number of yards there are. Help them see that what they did was to divide the total group of 27 feet into groups of 3 feet and that this is a division situation. Let someone write the equation on the board.

Problem E might be worked out also with a ruler and yardstick. Discuss Problem F.

Exercises A to V should be discussed before the children find the answers. For each exercise have a pupil tell whether a smaller unit of measure is being changed to a larger one or a larger unit is being changed to a smaller one. Then have the children tell whether they should multiply or divide to get the answer. When this has been done, assign the exercises as written work. Tell pupils to write the letter for each and the answer. If they have any trouble, tell them they should make an equation and think what is happening. Provide answers and discuss the exercises that caused the most trouble.

Providing for the able pupil

Additional problems on the reduction of measures may be provided on cards and used as suggested in Activity 13, page 337. Be sure the multiplication and division basic facts involved do not go beyond the 36 group.

Helping the slow learner

Slow learners may have difficulty with this lesson because they do not remember the basic equivalent measures. To help them recall these, have pint, quart, and gallon containers available and let pupils fill them with dry materials. Also let them work with a yardstick and ruler to find the equivalents. A good look at a calendar should help them see the relationship between number of days and number of weeks. You might also let them make posters illustrating what they have just reviewed about measures.

92-94 Exploring problems; Keeping skillful

Lesson Briefs for these lessons are on pages 94-96.

Overview

In this lesson children review another type of additive situation that is solved by the process of subtraction. This is a problem situation in which they must find the number of items to begin with when the number of items added and the number of items resulting are known. The reteaching material is presented under the two headings "See" and "Compute," with illustrations that show how to build the proper equation and why the process of subtraction is used to find the missing number. On page 94, practice problems are provided, including some of the previously studied problem situations.

Teaching the whole class

Page 92: Some children collect and trade cards with pictures on them. Before you start to work with this page, give the children an opportunity to tell about their collections. Then say something like this:

Suppose you had 17 football cards, and you were given 11 more. How many would you have? What equation should I write on the board? [$17+11=\square$] *What must be done with the numbers now? Write the numbers in computational form, Joan, and add them.*

Now let's think about another type of problem. Suppose you had 23 football cards at the beginning of last week. You received some more during the week, and then you had 35 cards. Henry, write the equation for this problem on the board. [$23+\square=35$] *How do you find the missing number in this equation? Look at page 89 if you are not sure. Now write the numbers in computational form and find the answer.*

Now tell the pupils to open their books to page 92 and read the first problem, which is also about a boy who had trading cards. Then ask:

Is this problem like either of the problems we did on the board? How is it different? What number don't we know? Look at Picture A. Can you tell how many cards there are? So when we start to

write our equation, what must we write first? [▤] *What does it stand for?*

Call on a child to point out in Picture B the 15 cards Bill gave Jim. Ask the class what sign they should use to indicate that a group is joining another group. Get a child to explain what "+15" stands for.

Now have the pupils look at Picture C. Explain that this picture shows the total number of cards Jim had after Bill gave him 15. Ask how they can tell quickly that he had 41 cards. (Pupils should see 4 groups of ten and 1.) Have them look at the equation to see what else has been put there. Have someone explain what the 41 stands for. Ask what is the task at hand now. Tell the children that the work that follows will show them how to find the missing number.

Have the children look at Picture D and discover that it shows all of Jim's 41 cards. Tell them that 41 will be used to find the missing number.

Page 93: Continue somewhat as follows:

Why is a ring put around 15 cards in Picture E? The 15 cards inside the ring might be the cards Bill gave Jim. [*You may find it necessary to explain that for the present purpose any group of 15 cards could be ringed. The numerical value of the group of 15 is important; the exact identity of the group is not.*] *What does the large 15 stand for?*

Now look at Picture F. Why should the 15 cards be thought of as gone? How does the picture suggest that the 15 cards are gone? The number of cards left are those Jim had at first. When we imagine part of a group as gone from a total group, what should this make us think of? [*Subtraction*]

Relate the computational form opposite Picture F to the picture. Have someone read aloud the material under Picture F. Ask him to subtract to verify the work in the book. Then have the equation read with the correct numeral inserted.

For new Problem A, have the children read the problem and discuss the equation. Have someone subtract 35 from 82 on the board. Problems B and C should be discussed, too.

Page 94: Tell the pupils to solve Problems D to M. They are to do three things for each problem: write the equation that tells the story of the problem; put the numbers in computational form and compute; then rewrite the equation, supplying the missing number. Caution the children that not all of these problems are the same type.

When everyone has finished, have some of the pupils put on the board their solutions for problems that caused trouble. Allow each pupil to discuss and justify his equation and computation. The others may correct their solutions from the work put on the board. Then ask a pupil to read aloud the statement beside the flag.

For the first block of exercises (A to F) in the "Keeping skillful" section, call on pupils to tell whether they should add or subtract to get each answer. Then have them do the necessary computation and write each answer beside its identifying letter. For the second block of exercises (A to R), have the children give the answers orally. These exercises may also be used for written work.

Providing for the able pupil

Cards with problems for which children must find how many things there were to begin with may be prepared for use as independent work. See Activity 13, page 337.

Helping the slow learner

Slow learners may experience difficulty with problems in which they must find how many there were to begin with. They should be given many opportunities to dramatize such problem situations with objects. For example, let children work in pairs. (An able child might be paired with a slower child.) Each pair needs a box of objects (shell macaroni, stones, jacks, corn, corks, etc.) and a cloth about 12 inches square.

One child will take a handful of objects (without knowing how many) and put them under the cloth. The other child will then take a group of objects out of the box and count them. He will put these on top of the cloth. Then one of the children will remove the cloth so that all of the objects fall into one group. One of the children will count all of the objects. Tell them to find out how many objects were put under the cloth. This they can do, of course, by removing the known group from the total group and counting the remainder. The children should then write an equation to tell what happened and compute to find the answer.

95-96 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons are on pages 96-98.

Expanded Notes are not considered necessary for these lessons.

97 Thinking straight

Lesson Briefs for this lesson are on pages 98-99.

Overview

On this page the children begin to distinguish between situations that require an exact answer and

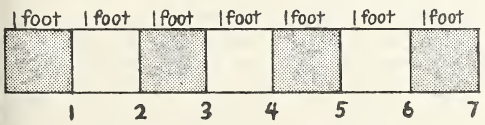
situations that require approximations only. They also develop judgment about rounding off numbers and quantities and using approximate measurements.

Teaching the whole class

To begin the lesson, let the pupils discuss occasions when an approximate answer will do just as well as, if not better than, an exact answer. Suggest the following situation as one example. Suppose several grades are giving a party together, and a decision must be made about where to hold the party (in a small room, such as a classroom, or in a much larger space, such as the gymnasium). Would it be necessary to know *exactly* how many children were going to be present, or would it be all right to know *about* how many would be there? Tell the children that this "nearly right" answer is called "approximate."

Another example you might use is estimating a quantity. For example, say: "Suppose you have 30 packages to tie with ribbon, and you know that the largest package will take about 32 inches of ribbon. About how many yards of ribbon will you need?" (About 30 yd., since 32 in. = approximately 1 yd.) Let the children suggest other situations where it is sufficient to know only an approximate quantity; and then ask for examples of occasions when an exact answer is required.

You also may find it helpful to use the following activity. Mark off a long strip of wrapping paper into foot units, as shown below:

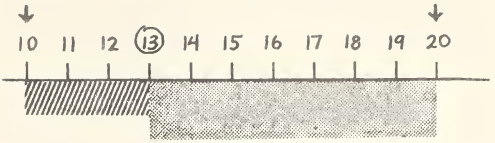


This can be placed on the chalkboard or on the bulletin board. Cut pieces of string of various lengths for the children to measure to the nearest foot. Have pieces that measure slightly beyond or not quite to foot marks, beyond or not quite to half-foot marks, and pieces that measure exactly a foot. Measuring the strings against the strip of paper will help the children get the idea of rounding off.

The use of a number line like the one in the next column can help children visualize whether a number, such as 13, is nearer 10 or 20.

The problems on page 97 provide material for introducing these ideas concerning approximations. They also help point up some of the variations that occur in approximating answers.

Page 97: Tell pupils to read the statement after the heading "Thinking straight." Have them read what Sue and Ann said in Picture A. Then have them



read Problem A and answer the question. Have them read Question B and answer it. If a child disagrees, give him an opportunity to justify his opinion.

Tell them to look at Picture B and read what Don and Bill said. Have them read Problem C and fill in the number where the screen appears.

The remainder of the work on this page should be done orally. Permit discussion of each answer. Call attention to the fact that for some problems a number should be rounded off to a smaller number and for others a larger number should be used. (For example, for Problem G, "80 apples" is the better answer; while for Problem J it is better to use the larger approximation.)

Providing for the able pupil

Let the children use round numbers to express the seating capacity of the school auditorium, the number of pupils enrolled, etc. You will need to provide the actual figures.

You may also provide selected data, such as small population figures, distances, etc., and ask the children to express the amounts given in round numbers. (Be careful to select numbers that can be easily comprehended by the children.) In each case, tell pupils the unit they are to round to—for example, to the nearest thousand for population figures.

Helping the slow learner

Advertisements from newspapers, showing grocery prices, etc., can be used. Ask the pupils to round these prices to the nearest dime.

Use other advertisements to provide experience in rounding off prices to the nearest dollar. The children may cut the advertisements from the paper and paste them on cards, identifying each card with a letter. Tell the children to pretend that they are going to buy each article. They are to write, in round numbers, how much money they would need to buy each article. You may need to remind them that, since they are buying the article and must have enough money to pay for it, they must round off the price to the next *higher* dollar.

The same cards may be used for another activity. This time the children should pretend that they are only pricing the articles. They do not intend to buy them. They should express the price to the nearest dollar, and they may round off each price to either the next higher or next lower dollar. Children may

carry on this activity in groups, or it may be used for written work.

98-100 Thinking straight

Lesson Briefs for this lesson are on pages 100-102.

Overview

The work on page 98 provides for review of mental calculation with two-figure numbers. On pages 99 and 100 the work is extended to three-figure numbers.

Slow pupils may not be able to proceed beyond page 98, and they should not be required to do so if they are having difficulty in mentally computing with two-figure numbers. The mental addition of three-figure numbers on page 99, followed by the mental subtraction of three-figure numbers on page 100, is intended for the better students only.

Teaching the whole class

The child's interest in experimenting with mental computation may be aroused by making a game of it. Do not try to enforce any standard of achievement, or push any child beyond his capacity. Let pairs of children act out the situations pictured, and encourage the able students to invent other problems to dramatize. Refer to mental computation as a "short cut," since most children will find this idea appealing.

The difference between computing with pencil and paper and computing "in one's head" should be carefully explained and discussed. The fact that in mental calculation the starting point is usually with the *large* part of the numeral, rather than the small part, may seem strange to the children, but remind them that the larger amount was also the starting point for counting money. To begin with the largest amount possible is really the only general direction that can be given. There are no "rules" in mental calculation, although there are several tricks that may be applied. For example, in an addition example such as $84+69$, some children may want to change both numerals to the nearest easily manageable unit. They may think: $80+70=150$; $150+4=154$; $154-1=153$. Other children may follow the plan of changing only one of the numerals to be computed. They will think: $84+70=154$; $154-1=153$. Furthermore, the nearest "easily manageable unit," in a particular situation, will not be the same for each child. The majority of children will find numerals ending in "0" preferable, but a few children may find numerals ending in "5" equally convenient.

In subtraction situations there are two possible changes to be considered: making the last figure of each numeral the same (as Jane did in Picture D on page 98) or the method followed by Ann in Picture C on page 98—changing one numeral to make it end in zero. (Note that both changes may be either upward or downward; Ann changed 38 to 30 and subsequently had to subtract 8 more from the remainder. If she had changed 38 to 40, she would have been obliged to *add* 2 to the remainder.)

The children will show great variety in their ability to calculate mentally. Ingenious pupils will discover ingenious ways of arriving at an answer. Others may need to make written notations of partial answers to assist them in arriving at a final answer. They should be permitted to do so.

One fact about the nature of subtraction, which children may stumble upon in this type of activity and which therefore may require explanation, is that if the same amount is either added to or subtracted from *both* numbers before one is subtracted from the other, the answer will remain unaffected, since the difference between the two numbers has not been changed. For example, in the problem $27-12=15$, if 3 is added to each number, the answer will be unaffected: $(27+3)-(12+3)=30-15=15$. If 2 is subtracted from each number, the answer will also be unaffected: $(27-2)-(12-2)=25-10=15$. This observation can be made only about subtraction, and only then if *both* numbers in a subtraction problem are changed in exactly the same way. If only one number is changed, the final answer will have to be adjusted to reflect the change.

Page 98: Write $57+64$ on the chalkboard. Let one boy pretend to be Don and another Bob and have them read aloud the conversation in Picture A. Ask someone to explain why Bob added 7 and 4 and then added 11 to his first total. Draw attention to the fact that Bob changed both numbers before computing. Ask the pupils if Bob's computation is correct and tell them that, as the scenes are read, they are to verify the answers that are given. (Allow slower learners to make penciled notes.)

Let another pair of boys read the conversation in Picture B while the other children participate by reading Question A and answering it. Ask the children if they can think of other ways to solve this problem mentally (for example, $60+57=117$, $117+4=121$; $65+50=115$, $115-1+7=115+6=121$; $65+55=120$, $120-1+2=120+1=121$). Discuss the various ways that have been suggested and ask which way seems easiest. (The children may not agree. They should understand that *any* way that works well or seems easy to them is a good way, and that what may seem like a good way to one person will not necessarily seem like a good way to another.

Next write 84—38 on the chalkboard, and let two girls read the conversation in Picture C. Have the children answer Question B. Let another pair of girls read the conversation in Picture D, and have one of the children answer the first question in Problem C. (Encourage as many children as possible to answer the last question in Problem C and have the others verify the computation suggested. Those who need to may use a pencil.) Direct attention to Problem D and write 50—28 on the board. Let a child read the problem and the partial solution and let another child explain whether 2 must be added to or subtracted from 20 to complete the problem. Have him justify his explanation. Let another child try the method suggested in Problem E. When he has given the answer to 58—28, let the class decide upon the next step.

The exercises at the bottom of the page may be acted out by pairs of children before the rest of the class. Encourage pupils to find several different ways of arriving at each solution by mental computation.

Page 99: Before beginning this work with the able pupils, get the slower learners started on an activity based on page 98. Write several addition and subtraction exercises on the board, using two-figure numerals only, and let the slower pupils pair off and begin working these out. Tell them that, if they need to, they may use pencil and paper to keep track of partial answers as they go along. Then start a pair of the more able students on Picture A, page 99. Treat this page just as you did page 98. When the children are well started, they will be able to carry on while you return to the slower pupils.

Page 100: Let able students work out the subtraction problems and exercises on this page just as they did the addition situations presented on page 99. Let the slower pupils continue with two-figure numerals.

Providing for the able pupil

Able students will enjoy playing "Cork Drop" (see Activity 11, page 336), using three-figure numerals on the corks, and keeping score by adding mentally. One player should act as a "checker," to verify the scores.

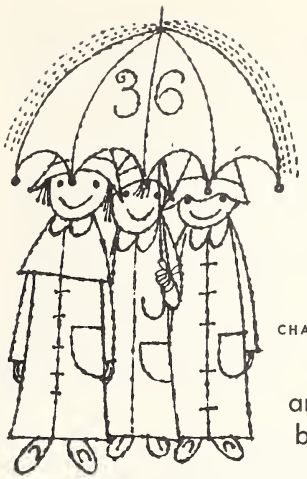
Helping the slow learner

The game of "Cork Drop" (see Activity 11, page 336) may be geared to the level of the slow learner by confining the numerals on the corks to two figures and allowing plenty of time for scoring.

101 Using arithmetic

Lesson Briefs for this lesson are on pages 102-103.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Multiplication and division facts beyond 36 group

In the *Seeing Through Arithmetic* program pupils are introduced to all of the addition and subtraction basic facts by the middle of Grade 3. By the end of that grade they have also been introduced to the multiplication basic facts with products through 36 and the corresponding division basic facts with dividends through 36. All of these facts have been reviewed in *Seeing Through Arithmetic 4*. By the middle of Grade 4, all pupils should be introduced to the remaining multiplication basic facts with products from 40 to 81 and to the corresponding division basic facts. This is done on pages 102-117. With this organization for learning, adequate time (at least a half year) remains in Grade 4 for pupils to practice recalling and applying these basic facts.

In learning the multiplication basic facts through the study of concrete situations, the pupil must first observe that equal groups are to be combined. He must note the number of objects in each group and the number of equal groups. Finally, he must find out how many objects are in the product, or combined groups. When the product is a number as large as 40 or more, the process of counting them one by one is laborious and subject to error. Consequently, in *Seeing Through Arithmetic 4* the final step is accomplished not by mere counting but by using the principles of grouping according to the number system. Thus groups of ten are identified and their number determined to arrive quickly at the tens' figure in the product.

In learning the division basic facts for dividends as large as 40 or more, the situation is reversed. Here the

first task is to perceive how many objects are in the original, or dividend, group. In this book, objects are shown arranged in rows of ten, and thus the tens' figure in the dividend may be easily determined. Thereafter the problem is to discover how many groups of a specified size can be made out of the dividend. When children learn the division basic facts by seeing groups divided into subgroups, and then enumerating these subgroups, they understand the nature of the process. Motivation for learning the facts can be established, and demands on pure memory reduced. In *Seeing Through Arithmetic 4* every multiplication and division basic fact with a product or a dividend from 40 to 81 is introduced pictorially by the methods outlined above.

102-104 Moving forward

Lesson Briefs for this lesson are on pages 103-105.

Overview

The multiplication basic facts for the 40, 42, 45, 48, and 49 groups (products of 40, 42, 45, 48, and 49) are introduced in this lesson. All of the facts are illustrated by pictures of objects arranged in equal rows. The rows are to be viewed separately at first and then as combined into one group. Since the rows can be viewed both horizontally and vertically, each picture illustrates two multiplication basic facts, each the reverse of the other. In Picture A, page 102, $5\times8=40$ and $8\times5=40$ are shown. Rings are used to enable the children to see the product quickly. Pupils should understand that since each ring encloses ten objects, they can quickly count the groups of ten and the single objects to determine the total. Their knowledge of the number system makes it possible for them to identify the number immediately.

Page 104 provides problem situations whose solutions require knowledge of the new basic facts. The exercises at the bottom of the page will help you find out how much each child has achieved.

Teaching the whole class

You might begin this work by helping the children recall how the numbers 36, 35, 32, 28, 27, 25, 24, 21, 20, etc., are made by multiplying. Let the children take turns in giving the basic facts for some of these groups. Also, if some of the children have made multiplication practice cards arranged by "tables" (see Activity 21, page 340) and think they can say the "tables" for the facts through 36, let them do so. Refer also to the multiplication fact chart if the class made a permanent one (see Activity 24, page 342). Let one of the slower learners use it, pointing to the groups and the answers as he "multiplies." Point out that there are still some unfilled squares, although not many. Tell the children that they will be able to fill in some more squares after they have completed this lesson.

As a challenge to the more able pupils, you might ask them to figure out what number should come next in the "5" row on the multiplication chart. Some of them will see that the numbers in the squares increase by five each time and will be able to give the correct answer, 40. Be sure they think of 40 as the product of 8×5. These pupils will probably then want to give the number for the last square. Suggest to the class that they turn to page 102, where they will learn how to make the numbers 40, 42, 45, 48, and 49 by multiplying.

Page 102: Ask the children to recall how the pictures in their books showed the multiplication basic facts for groups through 36. The children should remember that objects were shown in rows and were thought of first in separate rows and then as combined into one large group. They should remember, too, that they could view the rows of objects in two ways, and that each picture showed two facts.

Ask the children to cover the text on the page and decide which facts the two movies show. In discussing the first scene of Movie A, get the children to see that, viewed one way, there are 5 rows of 8 shells; viewed the other way, there are 8 rows of 5 shells. Have the pupils look at the second scene to discover the total when the rows are all combined. Help them recall that each ring encircles ten shells; consequently, the second scene shows 4 tens, or 40. Help them make the generalized statements that 5 eights equal 40, 8 fives equal 40, $5\times8=40$, and $8\times5=40$. To verify what they have discovered, let them uncover the right side of the page and take turns reading and completing the statements.

You might also let one of the able pupils find the square on the multiplication chart in which the second 40 (the product of 5×8) can be placed.

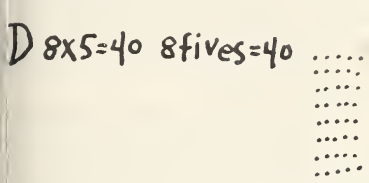
Treat Movie B in the same way, and then have the new products put on the chart in the proper places.

Page 103: Adapt the procedures suggested for page 102 to the material on this page.

Page 104: Let the children discover that for Movie E only one fact is shown. Be sure they understand why.

Problems A to D may be treated orally. If objects are available, it might be well to let the slower children use them to demonstrate the solutions. Then have them find the movie in the lesson that shows the basic fact involved in each problem.

For Exercises A to I, have the children do the following for each equation: write the equation with its answer; write the fact in another way; show the fact by a "picture" (dots, circles, triangles, X's, etc.); and write the related fact in equation form. (There will be no related fact for E.) A sample answer might look like this:



In discussing these exercises, focus attention on which number in each equation stands for the number of groups and which stands for the size of the groups. If necessary, have the children refer to the pictures to make these distinctions. For example, in Exercise A, reference to Movie D (looking at the horizontal groups) shows them that the numeral at the left of the times sign [6] stands for the number of groups, and the numeral at the right [8] stands for the number in each group.

The computational form of the basic facts in Exercises A to I has not been shown, but you may wish to have the children write them in this form. (When the children write the facts in computational form, they may use either numeral as the multiplier.) Strictly speaking, the computational form of multiplication is not needed with the basic facts. But since this form appears in achievement tests, it is well to bring it to the children's attention. You might write the computational form for Exercise A on the board and let the children refer to it for guidance.

Exercises A to J may be used for oral work. For Exercises A to E, ask the children to give the equation and supply the answer.

Providing for the able pupil

Activities 18 and 27 may now be extended to include the multiplication basic facts through the 49 group. See pages 339 and 345 for complete details.

If the practice cards for Activity 19 were used in reviewing the multiplication basic facts through the 36 group, new cards may be added to the pack for the number groups from 40 to 49. See page 340.

If the children have been constructing multiplication "tables," as suggested in Activity 20, page 340, let them put the newly learned facts in appropriate "tables."

Activity 21, page 340, may also be extended to include the basic facts with products from 40 to 49.

Helping the slow learner

Multiplication basic fact practice cards may be made for the facts that cause trouble in the 40 to 49 groups. See Activity 5, page 332, for description.

The graph-paper squares suggested in Activity 22, page 341, may help the slower pupils to visualize the multiplication basic facts for the 40 to 49 groups.

A "football game" can be used to give the children practice in reviewing the multiplication basic facts through the 49 group. See Activity 25, page 343.

Activity 23, the "Hundreds' Board," described on page 341, may also be used to give children practice on the multiplication basic facts.

105-107 Moving forward

Lesson Briefs for this lesson are on pages 105-107.

Overview

The numbers that the children saw being made by the combining of equal groups in the last lesson (40, 42, 45, 48, and 49) are now shown being separated into equal groups. In this way children learn the division basic facts for dividends of 40, 42, 45, 48, and 49. These are the first *new* division basic facts presented in this book.

Two-scene or three-scene movies are used to illustrate these basic facts. The first scene shows the total number of objects. Since these pictures involve large numbers of objects that would be hard to count, the objects are always arranged in rows of ten. By counting the number of tens and any single objects left over, children can quickly find out the total number pictured (the dividend in the abstract fact). The second (and third) scene shows this total group separated into equal groups of a certain number. Rings show these equal groups. By counting or "seeing" the number of objects within one group, children determine the size of the equal groups (the divisor in the abstract basic fact), and by counting these groups, they find the number of equal groups into which the total group can be separated (the answer or quotient in the abstract basic fact).

On page 105 the division basic facts for the 40 and 49 groups are introduced. On page 106 the 42 and 45 groups are presented. On page 107 the basic facts for the 48 group are presented, and some of the facts just taught are used in problems. Additional exercises are provided for checking the children's achievement and their familiarity with the various ways of expressing the basic facts.

Teaching the whole class

Page 105: Have a pupil read the statement after the heading "Moving forward." Lead the class to see that

they will be learning more about the numbers they have just studied.

Call attention, then, to the first scene of Movie A. Ask the pupils to find out how many bells there are in the top horizontal row. When the children find that there are ten bells, ask them how many rows of ten bells there are and how many bells are shown in all. Have the first statement read to verify what they found.

Next call attention to the second scene of Movie A and draw attention to the rings around groups of bells. Get the children to see that there are 8 bells in each group. Suggest that such separation should make them think of division. Then direct attention to the text at the right and have it read aloud. Scene 2 of Movie A will help pupils find the missing numbers.

In discussing Scene 3, point out that these are the same bells, arranged in the same rows. This time they have been separated by rings into equal groups of another size. Have the children find out the size of the groups and how many groups there are. Then let them take turns in reading and completing the statements at the right of the picture.

Direct attention to Scene 1 of Movie B. Help the children see that there are only 4 rows of 10 jacks. The fifth row has only 9 jacks. They should see immediately that the number represented is 49. Lead them to see that in Scene 2 the 49 jacks have been separated into equal groups of 7 each. Have them determine the number of equal groups. They can then use the information they have gained to supply the missing numbers in the statements at the right of the movie. To help the children see that there is only one division basic fact for the 49 group, let them try to separate 49 objects into other equal groups.

Page 106: Teach this page in the same way you taught page 105.

Page 107: Adapt the procedures used for pages 105 and 106 to the movie and text on this page.

If the pupils have boxes of objects, you might let two children demonstrate the basic facts just studied by manipulating the objects. They can separate the groups into smaller equal groups by moving the objects apart. Have the other children write in equation form the basic facts that have been demonstrated. If you wish, you may also ask them to write the facts in computational form.

Activity 27 (described on page 345) may be adapted and used here to emphasize what the children have just studied. For this activity prepare sheets of paper on which equal rows of X's have been made whose totals number 40, 42, 45, 48, and 49, respectively. Give each child two sheets for each number group and tell him to circle the smaller equal groups into which the total group can be separated. Then he should write, in equation and computational form, the basic fact illustrated.

For Problems A to D you may want to use objects and let the children show the divisive action. For Problems C and D provide pennies, if you can. Then have the children write the proper equation for each problem and supply the answers.

In working with Exercises A to I, have the children first find the movie that shows each fact and then give the answer. Question the children also as to which numeral stands for the size of the groups and which for the number of equal groups. Help them see that in each case they are finding the number of equal groups into which the original group can be divided.

Exercises A to J may be used orally. For A to E, ask the children to give the equation and the answer.

Providing for the able pupil

Activities 18 and 27, pages 339 and 345, may be adapted to the division basic facts. See the suggestions in the last paragraph of the activity description.

Practice cards arranged by number groups may be made for the division basic facts just studied. See Activity 19, page 340.

Division tables may be made, as suggested in Activity 20, page 340.

Practice cards arranged by tables as suggested in Activity 21, page 340, may be another activity.

The game called "All-in-a-row" may be used. Prepare master cards and the small basic fact cards for the basic facts through the 49 group. See Activity 26, page 344.

Helping the slow learner

Individual division practice cards, similar to those described in Activity 5, page 332, may be used to help the children eliminate any difficulties with the division basic facts just studied.

If the multiplication basic fact chart suggested in Activity 24 has been made and is available in the classroom, show the slow learners how to use it to find any of the new division facts they may want to look up. See suggestions on page 342.

108 Keeping skillful

Lesson Briefs for this lesson are on pages 107-108.

Expanded Notes are not considered necessary for this lesson.

109 Side trip

Lesson Briefs for this lesson are on pages 108-109.

Expanded Notes (other than a suggestion for able pupils) are not considered necessary for this lesson.

Providing for the able pupil

Crossword puzzles are fun for children and can provide practice on number ideas. Activity 30, page 347, shows two samples of such puzzles.

110-113 Moving forward

Lesson Briefs for this lesson are on pages 109-111.

Overview

This lesson completes the teaching of the basic multiplication facts. Procedures used for teaching are the same as those used heretofore, namely: facts are pictorialized in two-scene movies; objects in the pictures are arranged in equal rows that may be viewed either horizontally or vertically, thus making it possible to teach two basic facts (each the reverse of the other) with the same movie; in the second scene, rings are used around groups of 10 to make it easy to identify the size of the total group. All the facts for the 54, 56, 63, 64, 72, and 81 groups are presented in this way. When the lesson has been finished, the first block of practice on page 113 may be used to evaluate the pupils' mastery of these basic facts.

Teaching the whole class

Page 110: Ask the children to recall the multiplication basic facts that make 40, 42, 45, 48, and 49. Let them use any means they want to show that they know these facts. Help them recall that two-scene movies were used to illustrate these facts in the book. Remind the children how the objects were arranged in equal rows that could be viewed in two ways), and also recall the purpose of the rings in the second scene. If the multiplication chart (Activity 24, page 342) is on display, point out the fact that there are only a few unfilled spaces. Have the children open their books to page 110 and read the statement opposite the heading "Moving forward." Then use Movies A and B, which illustrate $6\times9=54$, $9\times6=54$, $7\times8=56$, $8\times7=56$, and the procedures suggested for page 102 (Expanded Notes on page 284).

Page 111: For this page adapt the procedures suggested for page 102 (see page 284 of this guidebook).

Page 112: For Movies E and F let the children discover that only one fact is shown for each. Be sure they understand why. Continue to use the procedures that have been used in teaching the preceding pages.

Page 113: For the remaining work on multiplication on the top half of this page, adapt the procedures suggested for the problems and exercises on page 104 (Expanded Notes, page 284).

Now that all the multiplication basic facts have been presented, a good way to draw all the facts together is to use the class multiplication chart (Activity 24, page 342). All the blank spaces should have been filled in as the new facts were learned. Have children take turns using the chart in saying the basic facts. Assign one of the numbers in the top row to a child and have him say the facts, using as multipliers the numbers in the first vertical column at the left. For example, for the top number 7, the child should multiply 7 by each of the numbers in the first vertical column, giving the product that is shown in the space under the 7 column and in the horizontal row to the right of the number that is the multiplier. The more able children will probably see that the product increases by seven each time the multiplier changes, and that each time they go on to a larger multiplier 7 is added to the previous product. Encourage such generalizations.

Note that this activity does not involve memory work, since the children can complete any basic fact by reading the answer that is already provided. However, it is a means of helping them arrive at generalizations about the multiplication basic facts and see the facts as part of an orderly system.

Use the "Keeping skillful" exercises on this page as a separate lesson. The first block of work, Exercises A to E, may be handled orally. The second block of work, Exercises A to L, may be used as both oral and written work. The children should write the third block of work, Exercises A to L, in computational form, choose the correct process, and compute to find the answer.

Providing for the able pupil

If the children have been using Activities 18 (page 339), 19 (page 340), 20 (page 340), and 21 (page 340) to learn and review the multiplication basic facts, let them include the new multiplication basic facts.

Helping the slow learner

Activities 5 (page 332), 21 (page 340), 22 (page 341), and 25 (page 343), if previously used, may now be extended to include the new multiplication basic facts.

Master cards that include the new facts may be made for "All-in-a-row." See details for making the cards and playing the game in Activity 26, page 344.

114-117 Moving forward

Lesson Briefs for this lesson are on pages 112-114.

Overview

This lesson completes the teaching of the division basic facts. Three-scene (or two-scene) movies are used again to pictorialize the facts. The first scene shows the total group, with the objects arranged in rows of ten and single objects, making identification of the group easy. In the second and third scenes equal groups are ringed to suggest separation, or division. Each basic fact for the 54, 56, 63, 64, 72, and 81 groups is pictorialized in this way. To inventory the children's mastery of these facts, a block of practice is provided at the end of the lesson (the first block of exercises on page 117).

Teaching the whole class

Page 114: Let a pupil read aloud the statement after the heading, "Moving forward." Point out to the pupils that they are going to learn more about the numbers they have just studied.

Help the children recall that when they studied division basic facts before, the pictures showed objects arranged in rows of ten (sometimes with extra single objects) so they could find the number in the original group easily. Then, in other pictures they saw this group separated by rings into equal groups of a certain size. Have them look over Movie A to see if this procedure is used here. Get them to say the number of objects in the total group, the smaller equal groups into which it is divided, and the number of these groups. Continue by adapting the procedures suggested for page 105 (Expanded Notes, page 285).

Page 115: Adapt the procedures suggested for page 105 (Expanded Notes, page 285) to the pictures and text on this page.

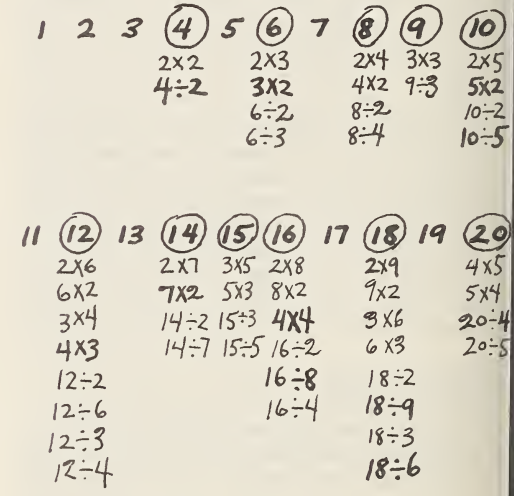
Page 116: Adapt the procedures used with the first two pages of this lesson to the material on this page.

Page 117: Apply the procedures suggested for the problems and exercises on page 107 (Expanded Notes, page 286).

This lesson completes not only the presentation of the division basic facts, but also the presentation of all basic facts. As with the multiplication basic facts, the class chart (Activity 24, page 342) may be used to review all the division basic facts. Show the children how to use the chart.

A number line chart can be used to review all the multiplication and division basic facts through 81 and to see their relationships. This activity can be a class project, and a permanent chart can be prepared for display in the classroom. (An illustration of part of such a chart is shown below. When the chart is completed, it should show all the multiplication and division basic facts through the 81 group.)

To start the activity, show the class the chart with just the numbers (no circles or basic facts) written in. Ask them to find the first number for which a multiplication fact can be given (4). Circle this number and call for a volunteer to give the multiplication fact and the division fact. Let the pupil write the two facts under the 4, writing the multiplication fact first. Continue by asking for the next number for which multiplication and division basic facts can be given and have these facts written under the number. A portion of the number line chart might look like this:



Providing for the able pupil

If Activity 20, page 340, and Activity 21, page 340 have been used, they may be extended to include the new basic facts.

Helping the slow learner

Activity 5, page 332, may be used to help the children eliminate individual difficulties with any of the division basic facts just studied.

Activity 25, the "football game," may be adapted to provide practice in the division basic facts. See page 343.

117 Checking up

Lesson Briefs for this lesson are on pages 114-115.

Expanded Notes are not considered necessary for this lesson.

118-119 Moving forward

Lesson Briefs for this lesson ore on poges 115-116.

Teaching the whole class

Remind the children that they have been studying numbers that can be divided into equal groups. As an example, let them pretend someone has 81 marbles and ask into how many groups of 9 these marbles can be divided. Then go on to explain that there are many numbers that they have not tried to divide as yet (23, for example). Give a child 23 objects and let him, in view of the class, try in various ways to separate these objects into equal groups with no remainder. If enough objects are available, other children may wish to experiment with other numbers (11, 17, 41, etc.)

Page 118: Ask the children to read the statement at the top of page 118. Then have someone read the text beside Picture A, using the picture to find the missing numbers. Proceed somewhat as follows:

How many blocks are in the picture? How many are in each group? Are these groups equal? How many groups of blocks are there? Are any blocks left over?

Direct attention to Picture B and its text. Have the children read the first sentence and examine the picture to make sure that 25 blocks are shown. (They can see that one extra block has been added to the 24 that were shown in Picture A.) Have them read the second sentence in the text and supply the missing number. Ask someone to answer the question that follows. Then have the children read the next sentence. Be sure they know the meaning of the word *remainder* and understand why it is used here. Have them read the equation.

Continue in the same way for Pictures C and D. Be sure the children use each picture to determine the number of groups and the remainder. Work for an understanding of the fact that the remainder is always smaller than the divisor. Be sure the pupils understand that if the remainder were not smaller, there would be at least one other equal group.

Page 119: Exercises A to I can be used for either written or oral work. Have the children work these exercises first according to the directions in the book. Then you might have them take turns giving the quotients and saying "no remainder" if there is none; if there is a remainder, telling what it is. For example, in Exercise A the child would say: "7 and no remainder, 7 and 1 remainder, 7 and 2 remainder, 7 and 3 remainder, 8 and no remainder, 8 and 1 remainder, 8 and 2 remainder, 8 and 3 remainder, 9 and no remainder."

If it seems desirable, the exercises can be done orally first and then written. If the children write the exercises, they should list first the numbers (with quotients) that can be divided without remainders; then the quotients and remainders for those that have remainders, using "rm." for remainder. For A, their papers should read: A 28-7, 32-8, 36-9, 7-1 rm., 7-2 rm., 7-3 rm., etc.

For the second block of examples for practice, the children can simply write "yes" or "no" after the labeling letter on their papers, or they can take turns answering orally.

The third block of examples for practice can also be done orally; but if this seems unnecessary, use it as a written exercise. Have the children write each equation and put the missing numbers where the screens are.

When all the practice has been completed and the answers verified, ask a pupil to tell in his own words what has been learned in this lesson. Then let someone read the lesson summary beside the red flag.

Providing for the able pupil

Ask these pupils to examine each exercise in the last block of practice on page 119 and for each one to write the next *smaller* numeral that can be divided evenly by the divisor given. For Exercise A, for example, they would write 25; for Exercise B, 49; and so on.

You might also prepare a set of cards, each of which shows a numeral from 11 to 25. Hold up a card (13, for example) and ask if any number can be divided into it without leaving a remainder. When the pupils have determined that 13 cannot be divided by any number (except the number 1, of course) without leaving a remainder, ask what the remainder will be when 13 is divided by 2, 3, 4, 5, and 6. A chart that summarizes all the division basic facts through the 81 group should be made. See Activity 33, page 349.

Helping the slow learner

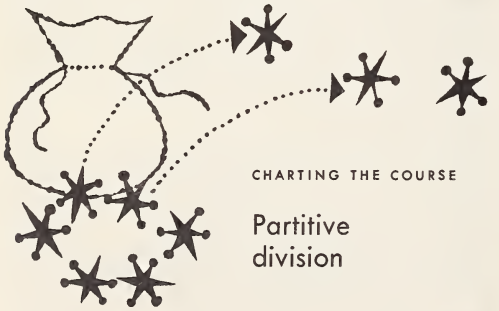
If the slow learners have difficulty with the practice work offered on page 119, they should be permitted to use objects. Their understanding of this lesson will be greatly increased if they have some experience with making equal groups and actually seeing the number of objects left over in some situations. Have them divide objects (15, for example) into equal groups in as many different ways as possible and note in each case whether or not there is a remainder.

A worksheet arranged like the one shown below provides practice in recognizing numbers that can be divided without remainders. Ask the children to use circles to show numbers that can be divided by

6 without a remainder. Then have them use squares to show numbers that can be divided by 7 without a remainder. Do the same for 8 and 9, using other methods of marking, such as an X over the figure or a line under it. The worksheet might look like this when the children have completed their work:

If you wish, a sheet may be used for each divisor.

"Remainders," a game for practice in dividing numbers with remainders, is described in Activity 34, page 349.



CHARTING THE COURSE

Partitive division

There are two kinds of divisive situations in arithmetic. In both situations the action starts with a group of objects whose number is known; the group, then, is separated into equal subgroups. In one of the situations the number of objects in the subgroup is known, and the number of such groups is to be found. This is the situation that has been used in *Seeing Through Arithmetic 4* to introduce the division basic facts. Suppose, for example, that a group of 24 stamps is to be divided into groups of 3 stamps. How many such groups can be formed? In this concrete situation, groups of 3 stamps may be formed, and the number of these groups counted. In symbols, this situation may be represented by the equation $24 \div 3 = \square$.

In the other divisive situation the number of objects in each subgroup is not known, but the number of equal groups to be formed is known. For example, suppose the 24 stamps are to be divided into 3 equal groups. How many stamps will there be in each group? In this situation the subgroups cannot be formed immediately because the number of objects to be put in each group is not known. An indirect method of operating must be used. In symbols, this situation may be represented by the equation $24 \div \square = 3$. Here the screen, or symbol for the unknown number, occurs as the *divisor* and thus shows that an indirect method of solution must be found.

In the concrete situation the simplest method of solution is to take the stamps one by one and put them into three piles, or groups. When all of the stamps have been so distributed, the number in each pile, or group, may be found. Careful observation of this action shows that 3 stamps are used in each "round." In other words, instead of being taken one by one, the stamps could be taken in groups of three and then distributed one by one. Seen in this way, the original situation is changed to one of the type first discussed. The question becomes, again, "How many groups of 3 may be formed?" Thus the solution of the first equation, $24 \div 3 = \square$, is also the solution of the equation $24 \div \square = 3$.

For a good many years the teaching of arithmetic emphasized computation with number symbols and neglected the analysis of situations of this kind. When, however, the objective of understanding or insight into arithmetic situations becomes dominant, demonstrations with concrete objects, or dramatizations of situations, at the same time become a prominent feature of methods of teaching. When this is true, this second type of situation (called "partitive division") must be demonstrated in a manner different from that used for the first type (the "quotitive" or "measurement" type). Thus it happens that modern objectives, if they are accepted by the teacher, force attention upon a different and

distinctive method of teaching partitive division. Pages 120-123 of *Seeing Through Arithmetic 4* provide the teacher with such a method. They also provide the pupil with a set of learning experiences through which he can recognize and understand problem situations that involve partitive division and so increase his power to solve problems.

120-123 Exploring problems

Lesson Briefs for this lesson are on pages 117-119.

Teaching the whole class

Children who have used the *Seeing Through Arithmetic* program will have encountered work on partitive division in Grade 3. For these pupils this lesson can serve as review. Note, however, that the lesson is as carefully and elaborately developed as it was in Book 3. Consequently, the children who are meeting this topic for the first time will not be at a disadvantage.

If classroom demonstration of partitive division seems desirable, use such objects as pieces of chalk, paper clips, beads, small blocks, etc.

Page 120: Let any pupils who have stamp collections tell about the different kinds of stamps they have and what they do with their extra stamps (if, for example, they give them to friends who are also collecting stamps or if they trade them). Then have everyone look at page 120 to see what Bob, Dick, and John are going to do with 24 stamps. Have the pupils read the problem, but explain that they are not expected to answer the question until later. Let a child read aloud the statement after the short arrow and look at the picture. Draw attention to the red 24 and the text beside it. Tell the children that the red 24 is the beginning of an equation that will describe what the problem says.

Have the children read the next three lines of text and look at the picture to see what is happening. Ask someone to explain why the division sign is followed by a screen instead of a numeral. Have the statement opposite the equation read aloud.

Tell the children to read the text opposite Picture C and ask what has happened in the picture. Call attention to the equation and let a child explain the meaning of each symbol.

Page 121: Have the children read the sentence beside Picture D and look at the picture. (Be sure they realize that these stamps are the same stamps discussed on page 120.) Next direct attention to the text opposite Picture E and to the group of three stamps in the picture that have a ring around them. Make sure everyone understands that the three stamps are the group that is taken away from the total supply when the three boys each take one stamp. In other words, this group represents the first round of stamps that has been taken. Continue in the same way with Picture F, making sure everyone understands that the ringed group of three represents the next round of shared stamps.

Now call attention to the text opposite Picture G and ask a child to read it aloud. Direct attention to the picture, and ask someone to explain why the stamps are shown in groups of three. Ask why the 24 can be divided by 3. You may need to ask:

Each time the three boys took one stamp apiece, they removed a group of how many from the group of 24? How many groups of 3 did they remove?

Page 122: Have the children read the first sentence and look at Picture H. Get them to identify one group of 8 stamps as Bob's, the second group as Dick's, and the third group as John's. Then have the children look at the equation and read the accompanying text. It is important for the children to understand that when they divide the 24 by the 3, the numeral 3 represents a *group of 3 stamps,* and that these 3 stamps are the group of stamps that were taken away each time the boys took 1 apiece. Discuss Picture I and the accompanying text and equation. Let a child read the equation, supplying the missing number. Then ask the class to read the problem on page 120 again and to answer the question.

Work through Problem A with the class. In discussing the equation, make sure the children understand why the screen follows the division sign. After this problem has been discussed, all the children who feel ready to proceed by themselves should work the rest of the problems on this page without help.

Page 123: If possible, the children should work Problems D to M without assistance. Tell them to read the problem, decide what sort of situation is presented, write the proper equation with a screen (or square), and find the answer. Let the children discover that Problem G is different from the other problems in the set.

Both blocks of Exercises A to J in "Keeping skillful" may be used as oral work. Then, if there is time, they may be used as written exercises.

Providing for the able pupil

Activity 13, "Problem Cards," described on page 337, may be used for able students. Be sure that a considerable number of the cards contain problems of the partitive division type. The able students are to select

three such cards and work the problems as described in Activity 13. Note that the major objective of this activity is to make sure that these pupils can distinguish between problems requiring them to find the size of the group and those requiring them to find the number of groups.

Activity 35, the "Make up a problem" game, described on page 350, may be adapted to provide further experience with partitive division. In this case the child who is "It" writes on the chalkboard an equation with the screen following the division sign. Then the child he chooses makes up a problem to fit the equation. The game continues as described in Activity 35.

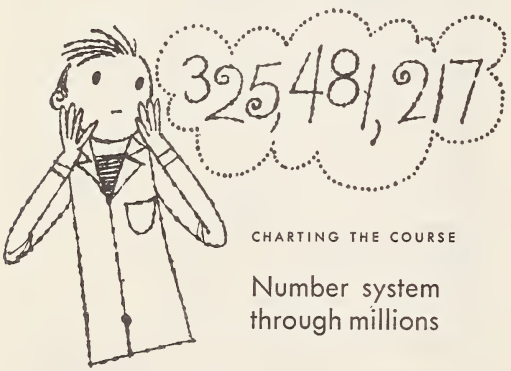
Helping the slow learner

Let slow learners make up and demonstrate division problems in which the size of groups must be found. Give them numbers to work with, and see that the problems concern objects easily found in the classroom—pencils, erasers, etc.

124-125 Checking up

Lesson Briefs for this lesson are on pages 120-121.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Number system through millions

The pupil who is learning arithmetic by the methods of the *Seeing Through Arithmetic* program has, by the middle of Grade 4, achieved considerable understanding of the number system. With this background of knowledge, he can easily learn to read and write rather large numerals. This ability is useful because he encounters such numerals in newspapers, magazines, and in the books he reads in learning geography and other subjects.

The pupil who has learned the principles of grouping on which the number system is based, and the names of these groups through thousands, needs to learn only one new name to be able to read or write any numeral less than one billion. The new word is *million*. This extension of the ability to read or write numerals is a consequence of the fact that numerals between one thousand and one million are read by repeating the groupings (and number names) used for numerals less than one thousand, and then saying the word *thousand*. Thus 481,217 is read "four hundred eighty-one thousand two hundred seventeen." The group of three figures on the left may be read as though the number were 481, and then saying the word *thousand*.

In a similar way any numeral between one million and one billion is read by using the basic groupings of hundreds, tens, and ones, and using the auxiliary word *million*. Thus 325,481,217 is read "three hundred twenty-five *million* four hundred eighty-one *thousand* two hundred seventeen." In *Seeing Through Arithmetic* various visual aids, on pages 126-128, help pupils learn how to make this truly enormous extension of their ability to read and write numerals.

An extension of the number system of a quite different sort arises in connection with the uses of zero and one. It is impossible to demonstrate such statements as $0\times 4=0$, $6\times 0=0$, and $0\div 8=0$ by using objects in concrete situations, and yet statements like these have a place in arithmetic because without them the number system would be incomplete. The generalizations that "The product of any number multiplied by zero is zero" and "The quotient of zero divided by any number is zero" must be accepted because of the way they fit in with the facts in arithmetic, and not because they can be demonstrated by concrete examples. Learning experiences designed to guide pupils to this and several similar generalizations are provided on page 129.

126-128 Moving forward

Lesson Briefs for this lesson are on pages 122-124.

Overview

Pages 11 and 12 of *Seeing Through Arithmetic* provided a review of the reading and writing of numerals through four places. This lesson extends the knowledge of reading and writing numerals through nine places; pages 126 and 127 provide experience in reading and writing numerals in the thousand

(numerals of 4, 5, and 6 figures); page 128 provides practice in reading and writing numerals in the millions. Quantities (both in thousands and in millions) are shown by pictures, by labeled tally spaces, by symbols, and by words. Exercises that give children practice in translating numerals into words and vice versa are provided on pages 127 and 128. In some of these exercises, the figures in thousands' place have been printed in red to enable children to distinguish the thousands quickly.

Teaching the whole class

You will find it helpful to have a number of empty boxes of several sizes on hand. Label these boxes 10; 100; 1000; 10,000; 100,000; 1,000,000; 10,000,000; and 100,000,000. You do not have to worry about true scale as long as you keep the larger quantities consistently represented by slightly larger boxes. Three boxes of each size will be sufficient. You will also need three small objects to represent ones. This equipment will be used to help the slower learners understand the relation of hundreds to thousands and of thousands to millions. Complete directions for an activity of this nature will be found at the end of this block of lesson notes under the heading "Helping the slow learner."

Before beginning this lesson, you may wish to review the work with three-figure numerals on page 11 to reinforce this idea: In writing a three-figure numeral we have places for the ones, tens, and hundreds. In writing a six-figure numeral, the three figures that make up the thousands' part of the numeral also represent ones, tens, and hundreds. But in this case the figure in ones' place stands for thousands, the figure in tens' place stands for *ten* thousands, and the figure in hundreds' place stands for *hundred* thousands.

In the same way, place value for hundreds, tens, and ones is maintained when writing numerals in the millions. For example, in a nine-figure numeral, the three figures that make up the millions part of the numeral represent hundreds, tens, and ones; but in this case the figure in ones' place stands for millions, the figure in tens' place stands for *ten* millions, and the figure in hundreds' place stands for *hundred* millions. You might even point out that this system goes on and on—that no matter how large the numeral is, it can always be named by separating it into groups of three, providing, of course, that one knows the special name for each group of three, such as thousands, millions, billions, etc.

Page 126: After reviewing three-figure numbers, you might introduce the work on page 126 by asking if any of the children have ever been in a hardware store. (If none of them have had this experience, describe boxes of nails, screws, bolts, etc.). Discuss why it is necessary to have various sizes of boxes [different quantities].

Next have everyone look at the first scene of Movie A on page 126. Tell the children to find how many tacks each box contains. Let a child count aloud by thousands to determine the total number of tacks.

Then direct attention to the tally space below the boxes. Ask how many sections there are on each side of the center mark, and discuss the meaning of these sections—that they represent the places where figures might be written. Bring out that to represent any number in the thousands, at least four places will be needed, and as many as six places may be used. Direct attention to the word *thousands* under the left half of the tally space and ask someone to explain what it means [that figures written in any of these three places will mean thousands]. Discuss how many thousands each of these three places can represent. Ask someone why six places are provided in the tally space.

Direct attention to the symbol for nine thousand and ask a child to read the number words printed below it. Let another child relate the symbol and the number words to the boxes of tacks in the first scene.

Now let a child tell what is happening in the second scene of Movie A (another box of 1000 is being brought in). Have someone count the tacks by thousands. Ask a pupil to read the figure in the tally space and tell what it means. The slow learner may need the help of such questions as:

How many places for figures are there at the right of the figure 1 in the tally space? How many places do you always have for any number in the hundreds? How many places do you have here? Is it more than you need for a three-figure number? What is the largest number that you can write with three figures? [*999*] *How many places do you need to write the number that is one more than 999? Does the number 1000 represent the number of tacks shown in the picture? Does it represent* one *box of tacks? How many boxes of 1000 are there in the picture? How many are 10 one thousands? How many figures are in ten thousand? How many places will you need to write this numeral?*

Then tell the pupils to look at the numeral at the lower right, and have someone read the number words for it. Draw attention to the comma in the numeral and explain that it makes the numeral easier to read.

Explain that when we write a large numeral, it is customary to set off each group of three figures with

commas, and that when we do this we count from the right. The possibility that the thousands group may contain less than three figures (as in 9,000 or 99,000) is something the children must understand. Stress the fact that using commas to set off figures in groups of three makes the number easier to read. Point out also that beginning with the group of three that means thousands, each group has a name that must be said after the figures in the group have been read. You may need to keep reminding the children that each group of three figures is read just as if it were a number by itself and is followed by the name of the group.

If a pupil asks why no comma is shown in the 9000 in Movie A, say that it is not really needed because four-figure numerals can be read easily without commas. Tell the children that they may use commas in writing four-figure numerals if they want to, but that they should always use commas in writing numerals of more than four figures.

Direct attention to Picture B and ask how many nuts there are in each box. Tell the children to count the nuts by ten thousands. Remind them that ten tens equal 100. Then ask how many thousands ten ten thousands make. Let a child explain why the figure in the tally space correctly describes the number of nuts in the picture. Let another child read the symbol and the number words for this amount. Ask the class how many groups of three make up the numeral 100,000. Ask which figures mean thousands and belong to the thousands' group.

Page 127: Handle Picture C as you did Pictures A and B on page 126.

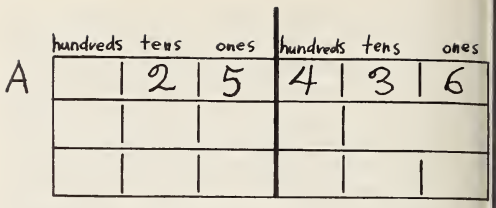
Direct attention to the first block of exercises (A to G). Explain that the part of the numeral that means thousands has been printed in red. Let children take turns reading these numerals aloud.

Children will find it easier to read large numerals correctly if they are told that they must say something for every figure in the numeral except zero. Children should also be told not to say "and" in reading numerals, since "and" should be reserved for reading the decimal point later on, for distinguishing between dollars and cents, and for distinguishing between whole numbers and fractions.

Have the numerals in Exercises A to U read aloud also. The figures that mean thousands have been printed in red in Exercises A to G.

Children may also make tally spaces and put the figures in the correct places for each of the numerals in these oral exercises. A sample tally space is shown in the next column.

Exercises A to V are to be written as directed.



Page 128: Treat Picture D in much the same way as you did the preceding pictures. Have pupils count the boxes of washers by hundred thousands, then tell how many boxes of one hundred thousand each there are. Ask the children what is done about tally spaces when there are 10 boxes of one hundred thousand. They should be able to state that a new tally space should be made. Have them tell how many places there are in the tally space in the book. Ask if a new group is shown in this tally space, and what its name is. Let someone tell what each place in the millions' group stands for. Ask why there are no figures in the tally space in the first two places in the millions' group. Call attention to the two commas in the number symbol for one million. Ask a pupil to read this numeral.

For the first block of exercises (A to G), explain to the children that when they read these numerals they are to say "million" for the figures in black at the left, "thousand" for the figures in red, and read the rest of the numeral as usual. Have pupils take turns reading these exercises and the two blocks of exercises that follow. (Call attention to the fact that in Exercises A to O they are given no help in recognizing and naming the millions' and thousands' group.) If necessary, remind them again that they must say something for every figure in the numerals except zero. Remind them, too, that the commas show how many groups there are, and that they read the figures in each group just like a number by itself and follow it by the name of the group, except for the last three figures.

Exercises A to G are to be written as directed.

Providing for the able pupil

Give able pupils numerals containing up to nine figures to illustrate on their papers. Suggest that they draw small boxes for small quantities and large boxes for large quantities. Have them label the boxes according to quantity.

Able pupils might also work together on a chart to be displayed in the room, such as the one pictured on the next page.

Such a chart provides an opportunity for the children to see that each column, going from right to left represents ten times as much as the preceding column.

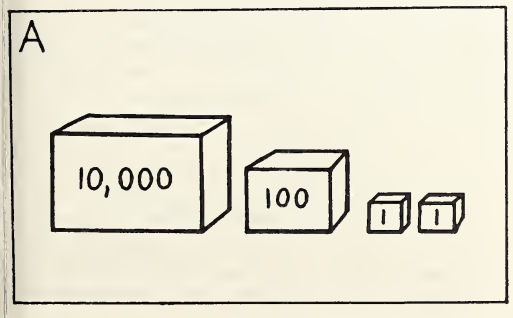
hundreds	tens	ones	hundreds	tens	ones	hundreds	tens	ones
MILLION			THOUSAND					
	11			002			800	
	5			007			310	
				350			005	
	278			720			070	
				49			000	
				8			206	
	405			031			060	

It helps to visualize the names of the places and shows what to say in reading the numbers by groups.

Helping the slow learner

Make up a series of numbers using only 1, 2, 3, and zero (for example, 321; 2300; 12,120; 310,233; 1,333,230; 13,220,123; 321,203,123). Write them one at a time on the chalkboard, starting with the smaller numbers. Give a group of slow learners the labeled boxes in graduated sizes and the 3 single objects you have previously prepared. Ask them to show with the boxes and objects the numeral you have written on the chalkboard. For example, to represent the numeral 2300, they would need two of the boxes labeled 1000 and three of the boxes labeled 100, and to represent 12,000, they would need one box labeled 10,000 and two boxes each labeled 1000.

You can also prepare cards lettered A, B, C, etc., on which you have made rough outlines of boxes labeled according to quantity, as shown in the illustration below:

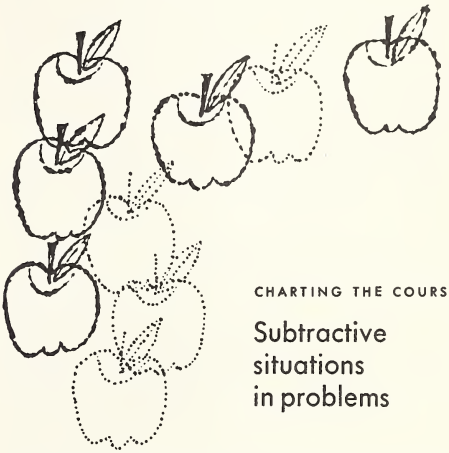


Opposite the corresponding letters on their papers, slow learners can write the numeral the illustration shows. Keep the numerals fairly small to start with.

129 Thinking straight

Lesson Briefs for this lesson ore on poges 124-125.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Subtractive situations in problems

Among the possible types of one-step problem situations is one in which a group of unknown size is taken from a group of known size. The number remaining is, however, known. The following is an example of this type: "The Brown family made 21 popcorn balls. By bedtime there were only 5 left. Sue said, 'I wonder how many popcorn balls we ate.' How many popcorn balls had they eaten?" The action in this situation is clearly subtractive. Traditionally, this has been called the "how many are gone" type of problem.

Children frequently have been advised to subtract in this kind of situation, and little attention has been given to why this procedure works. Thus, in the problem above, they subtract 5 from 21 and obtain the correct answer, 16. However, if an effort is made to demonstrate this situation with objects, a difficulty arises. In the situation, the number of popcorn balls eaten is not 5, but an unknown number. In symbols, the situation is represented by the equation $21 - \square = 5$. The child who sees this situation as it really is, either on his own or as a result of a realistic dramatization, needs to know why, in processing, the 5 can be subtracted.

In *Seeing Through Arithmetic 4* a problem situation of this type is analyzed for the pupils on pages 130 and 131, and the two following pages also are largely devoted to a study of this type of situation. Problem situations of this type differ in one important respect from others in which one of the groups involved in the action is unknown. In finding how many were added or how many more are needed, the action is additive but the process used to find the answer with number symbols is subtraction (pages 88-90). Also, in finding how many there were to begin with before a group of known size was added, the action is additive but the process is subtraction (pages 92-94). In finding "how many are gone," however, the action is subtractive and the process used with symbols is subtraction.

In another type of problem situation one must find how many items there were at first when the number gone and the number left are known. The following is an example of this type. "David had some minnows in a pail. He gave 11 minnows to Tom and kept 12 for himself. How many minnows were in the pail to begin with?" Here again the situation is clearly subtractive. In symbols, it may be represented by the equation □−11=12. It is not possible, however, to find the unknown number directly by subtraction because the minuend is unknown. The process used with number symbols is addition. The reason for this may be understood by imagining that the situation is restored to its original state. In the example, if the 11 minnows taken away are put back with the 12 that were left, this additive action would produce the group that existed in the beginning. Thus if 11 is added to 12, the result is the original number of minnows.

In *Seeing Through Arithmetic 4* the problem situation described above is explained for the pupil on pages 134 and 135, and the two following pages provide further learning experiences with this type of situation.

130-133 Exploring problems

Lesson Briefs for this lesson ore on poges 125-128.

Teaching the whole class

Page 130: Before beginning this work, let the children talk, if they wish, about popcorn balls they have made or bought. Then tell the class that on page 130 of their books they will find a problem about the popcorn balls the Brown family made. Have them read the problem and tell how many popcorn balls there were at first and how many were left after some had been eaten. Then have them look at Picture A to verify how many popcorn balls there were at first. Emphasize that the problem is to find how many popcorn balls the Brown family ate.

Explain that the large 21 represents the first part of an equation that will show the problem situation. Let someone tell what the 21 stands for. Lead the pupils to see that they are supposed to know that some popcorn balls were eaten, or removed from the original total number, but not how many. Ask them how Picture B shows this. Ask the class what they should think of when part of a group is removed from the whole group.

Have the pupils look at the next part of the equation opposite Picture B. Call on them to explain why the subtraction sign is used here and why the screen is placed after the subtraction sign. Then have the pupils look at Picture C and read the statement beside the arrow. Tell them to look at the completed equation and read what is said about the screen and the numeral 5. Tell them that the part of the text labeled "Compute" will show them how to find the missing number.

Have the pupils look at Picture D. Tell them these popcorn balls are the same ones that were shown in Picture A, rearranged so they can be counted quickly. Have someone read the text beside Picture D.

Page 131: Explain to the class that the popcorn balls in Picture E are the same ones that were shown in Picture D. Call on a pupil to read the statement beside the picture. Point out that a ring encloses 5 popcorn balls in the picture and explain that the large blue 5 stands for them.

Now direct attention to Picture F and to the 5 popcorn balls that have been dimmed off. Have the children read the statement beside the picture to find what this dimming off means. Work with Picture F until the children see that this dimming off of the group of 5 shows them why they can subtract 5 from the total group.

For the computational form, explain that the 21 stands for the original total group of 21 popcorn balls, while the 5 stands for the 5 uneaten popcorn balls that they are to imagine as gone from the total group. The screen stands for the number in the group of popcorn balls remaining (those in strong color).

Let the pupils subtract 5 from 21 and verify their answer with that shown in the computation below Picture F. Have the final equation and the statement after the arrow read. Then suggest that the children put 16 in the proper place in the equation and subtract to see if the answer does fit the equation.

Page 132: Continue by having another child answer the questions about Picture B. Let another pupil answer the questions beside the computation by referring to the picture. Let him subtract 12 from 36 and verify the equation by subtracting 24 from 36.

Problems A, B, and C may be treated orally. Each equation should be discussed thoroughly, and the children should be able to tell what each numeral or screen stands for.

Problems D to N (G to N are on page 133) may be assigned as written work. Tell the children to write each equation with a screen (or square) in the proper place and then to compute. You may direct them either to rewrite the equation with the answer in place of the screen, or to insert the answer in the square of the original equation.

Page 133: Have pupils finish the problems. Warn them that not all the problems will have the same solutions (Problems H, I, and L are different from the others). Then supply answers and let the children verify their work. Discuss the problems that have given difficulty, using the methods suggested in the Expanded Notes for pages 28-29 (see page 250).

Providing for the able pupil

Extra problems on finding how many are gone when the number to begin with and the number remaining are known can be provided by cutting them out of old textbooks and mounting them on 3″ x 5″ cards, as suggested in Activity 13, page 337. They can be used by the able pupils in their free time.

The "Make up a problem" activity described in Activity 35, page 350, should provide able pupils with an interesting independent group activity.

Helping the slow learner

The slower pupils may be helped by dramatizing situations of the "how many are gone" type. Let two or more children start with a group of objects whose number is known. Then one child removes some of the objects (any number he pleases), without letting the others know how many he took. They may, however, observe how many are left. Then the child who removed some should put them back. By removing the group that was left, the children can find how many he took. The situation should then be expressed in equation and computational forms.

134-137 Exploring problems

Lesson Briefs for this lesson are on pages 128-131.

Teaching the whole class

Page 134: Tell the pupils that now they are going to study another kind of problem situation. They will learn how to find how many items there were at first when they know the number gone and the number left. Have Problem A read aloud. Draw attention to the pail of minnows in Picture A and establish the fact that the number of minnows David had is unknown. Then ask the pupils why the equation must begin with a screen.

Let someone read the statement beside the arrow pointing to Picture B and explain what the picture shows. Ask the children what process they think of when a group is taken from a larger total group (subtraction). Get them to explain why ▒ − 11 shows what has happened so far.

Have the statements opposite Picture C read and let the pupils verify the data by examining the picture. Ask them to explain how the equation describes the problem situation. Tell the pupils that on the next page they will learn how to compute to find the missing number.

Page 135: Explain that Picture D shows the minnows David kept for himself. Let the children verify the number. Point out that the large 12 stands for the number of minnows David kept.

Then tell the pupils that Picture E shows the other group they know about—the 11 minnows David gave to Tom—and let them verify this number. Get them to explain what the large 11 stands for. Then go on this way:

How many minnows did David keep for himself? How many did he give away? Imagine that the 11 minnows David gave away have been put back with the 12 he kept. Look at Picture F. Does this picture show all the minnows David had at first? What does the shaded background mean? [*Combining or adding*] *How many minnows are in the top group? How many are in the bottom group? To find how many there are in all, what must we do? The computation at the right shows what we write when we want to add 11 to 12. Add these numbers. Now look at the computation under the picture. What should your answer be? Look at the equation at the right. If 23 is the correct answer, we can put 23 in place of the screen, subtract, and get 12. Do this. Is 23 correct for the number of minnows David had at first?*

Many children will benefit from an activity worked out with objects, as follows: Put 23 objects under a piece of cloth (only you should know that there are 23). Reach under the cloth and take out 11. Remove the cloth and let the pupils discover that 12 objects are left. Ask a pupil to write on the board the equation that shows what happened. Then put back on the table the 11 objects that were removed and have

someone determine the total. Have another pupil compute to find the answer.

Page 136: Have the new problem read and get the children to relate it to Picture A. Be sure they see that the number of weights in the box is unknown, but that the picture shows 4 weights being taken away. Have the pupils answer the questions about the equation, using the picture and the problem to get the answers.

Turn attention next to the "Compute" step. Call on a pupil to read the first question and point to the group in Picture B that shows the weights that Tom had left. Have another pupil read the next question and point out the group in the picture that shows the weights that are imagined as put with the 18 weights. Ask what the shaded background suggests.

Have the pupils examine the computation at the right and answer the questions. They should then add to find the missing number. Finish by having the equation read, with the missing number inserted. Let someone verify the equation by substituting 22 for the screen in the equation and subtracting.

Discuss new Problem A, since it is the first one without illustrations. Discuss each number and the screen in the equation and call on a pupil to put the computation on the board.

Page 137: Assign Problems D to L as written work. Warn the children that some of the problems are not of the type just studied; so they must read each problem carefully before they write an equation to fit it. Have answer sheets ready so that the children may verify their work. Then have a class discussion on the problems that seemed to cause the most difficulty. Work individually with the children who seem to need more help.

Providing for the able pupil

Cards with problems on them in which children must find how many items there were at first when the number gone and the number left are known may be prepared for use as independent work. See Activity 13, page 337.

Activity 32, page 348, may also be adapted to give practice in this type of problem situation. See the suggestion in the last paragraph of the description of this activity.

Activity 35, page 350, in which children are to make up problems for equations written on the board, may also be used by the able children in independent group work.

Helping the slow learner

Slower learners will need many opportunities to dramatize this new type of problem situation. The activity described for page 135, which requires objects and a piece of cloth, may be adapted as follows: Let the children work in pairs. (An able child may be paired with a slow learner.) Each pair needs a box of objects (shell macaroni, stones, jacks, corn, corks, etc.) and a cloth about 12″ square. One of the children takes a handful of objects out of the box and puts them on a table. Then, without counting the objects, the cloth is put over them. One of the children then reaches under the cloth, removes some of the objects, and counts the objects he took. The other child then removes the cloth and finds how many objects are left. The problem is to find how many objects were on the table originally. The slower child should solve the problem. He should see that he must put back the group of objects removed and count the total group. He then makes an equation that shows the problem situation and writes the numbers in computational form to find the answer—which is the total number of objects that were put on the table originally. If you prefer, the child may write the equation, one step at a time, as the action is performed.

138 Keeping skillful

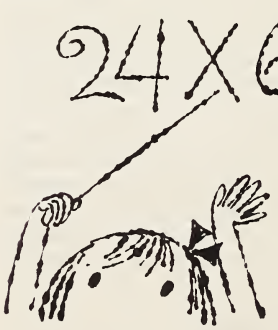
Lesson Briefs for this lesson ore on pages 131-132.

Expanded Notes are not considered necessary for this lesson.

139 Using arithmetic

Lesson Briefs for this lesson are on pages 132-133.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Multiplication process

The teaching of the multiplication basic facts was completed on page 113. Study of the process of multiplication with larger numbers can now begin and be pursued, without interruption, to an understanding o

the process as a whole. A thorough knowledge of the number system is essential to this understanding. When pupils do understand the number system, the process of multiplication can be viewed simply as a more or less elaborate regrouping operation that emphasizes tens, hundreds, thousands, and so on. Multiples of these basic numbers (for example, 20, 30, 200, 4000) also play a prominent rôle.

In *Seeing Through Arithmetic 4*, study of multiplication as a process begins with noticing the effect of multiplying 10 and multiples of 10 by a one-figure numeral. Closely associated with this is multiplying a one-figure numeral by 10 or a multiple of 10. These two situations initially involve quite different groupings, and this can easily be demonstrated with objects and pictures. Nevertheless, the product, for example, of 30×2 is the same as the product of 2×30. The latter is readily understood as 2 groups of 3 tens each, which is 6 groups of tens, or 60. Then 30×2, or 30 groups of 2, will also be 60. Examples of this kind may be used to lead to the generalization that the product of a one-figure numeral and any other numeral that ends in zero also ends in zero. Similar generalizations hold if the larger numeral ends in two or more zeros.

The multiplication process involves a variation in the carrying procedure that requires careful teaching. It is customary to begin by multiplying the ones' digit. Often this partial product is 10 or a number larger than 10. In these cases the number of tens is remembered until the next multiplication has been done, and is then added to this partial product. In *Seeing Through Arithmetic 4* this is taught visually by showing how one or more groups of ten in the partial product are put to one side until the next partial product has been found. In brief, the pictures show how the process can be dramatized with objects.

Similarly, in multiplying a numeral of three digits, any hundreds obtained from multiplying and grouping the tens must be remembered until after the hundreds' figure in the original numeral has been multiplied. This procedure is also shown pictorially in *Seeing Through Arithmetic 4*. The procedure can, of course, be extended to multiplying numerals of more than three figures, but this extension is not shown in this book. The application to multiplying dollars and cents is taught by pictorial methods on pages 154-156.

Multiplying by a two-figure numeral involves multiplying by ten or by a multiple of ten (for example, 20, 30, 80). Thus multiplying 32 by 26 requires that 32 be multiplied first by 6 and then by 20. To demonstrate this second step with objects requires that 20 groups of 32 objects each be combined. It is clear that demonstrations of this kind soon become unwieldy because of the large number of objects required. Consequently, teaching methods must make rather immediate use of the number symbols, and must from this point onward rely more and more upon basic understandings of the number system in explaining the process to children. Care must be used, however, or the explanations will be merely verbal manipulations and will not be really understood by the children.

140-141 Moving forward

Lesson Briefs for this lesson are on pages 133-135.

Teaching the whole class

Page 140: Tell the children that the objects pictured in this lesson are supplies that might be found in a school storeroom. Then have the pupils open their books to page 140. Ask a child what Picture A shows. Have another child read the first four lines of text. Then call attention to the picture below with the dotted background. Explain that these pencils are the same as those in Picture A. Point out that they have been arranged in 2 rows of 10. Ask someone what the dotted background suggests. [Combining] Then get the children to see that 2 tens equal twenty. Have everyone read silently the two numerical statements at the right and let someone supply the missing number in the equation.

Now have Problem B read aloud and ask another pupil to relate this text to Picture B and the scene with the dotted background below. Again, have everyone read the numerical statements and ask a child to supply the missing number in the equation. Point out that the scene with the dotted background illustrates both Problem B and Problem A. Get the children to discover that in multiplication the order in which the numbers 10 and 2 are taken makes no difference in the answer.

Before going on, if you wish, you might let groups of children use objects to determine that 2×10 is equal to 10×2.

Treat Pictures C and D and the accompanying text as you did the preceding pictures and text.

Page 141: Let a child read aloud the first four lines of text opposite Movie E. Ask another child to read the numerical statements. Tell him he can find the missing number in the equation by examin-

ing the second scene of Movie E. Then let a child read the text in Problem F, using the second scene again to find the missing number. Ask the children what they have discovered about the multiplication of 3 and 500. (That 3×500 is equal to 500×3.)

You might also ask how many paste sticks there would be if there were only two boxes of 500 each. In case the first answer you get is ten hundred, ask how else ten hundred can be expressed. (One thousand) Then ask how many paste sticks there would be if there were 500 groups of 2. Continue to present similar examples until you feel sure everyone understands that the answer to a multiplication problem does not change if the order of factors is reversed.

The first block of Exercises (A to D) may be used for oral work. Note that in these exercises the answer is to be thought of first as so many tens, and then as so many hundreds. This practice may be continued in the other two blocks of exercises, if you wish.

Providing for the able pupil

Activity 36, "Try for the Number," described on page 351, may be adapted for able pupils. Make the amount they can "go out" with 10,000 or more, and use the hundreds' set of numbered cards in place of the tens' set.

Helping the slow learner

Slow learners may play "Try for the Number," the game described in Activity 36, on page 351, if they use the tens' set of numbered cards in place of the hundreds' set. The amount they can "go out" with should be 1000 or more.

Another activity that will help slow learners involves the use of a Hundreds' Board. See Activity 23, page 341, for a description of how to make this board and how to use it in multiplication.

142-146 Learning how

Lesson Briefs for this lesson ore on poges 135-138.

Teaching the whole class

Before introducing the work on these pages, you might find it helpful to review with the children that multiplicative action is the putting together of equal groups into one big group. Remind them that by now they know the multiplication basic facts. If necessary, quickly review earlier pages on multiplication (pages 46-51, 102-104, 110-113).

Then ask the children if they have ever been to a hobby show. Let them talk about the different things they saw.

Page 142: Have the children read the statement on page 142 that tells them what they are going to learn in this lesson, and then direct them to read Problem A. Have the pupils examine Picture A and relate it to the problem. (Be sure they understand that each box holds 10 buttons.) Direct attention to the equation, and discuss what the numbers mean in relation to the picture.

Have the children next tell what is happening in Picture B. Make sure they understand that all the loose buttons are being put together first. Explain that the dimmed-off parts of the picture represent the groups that we are not concerned with. Direct attention to the computation and explain what the large black figures represent (the 3 stands for the 3 groups, and the 4 stands for the number of buttons in each group). Let someone tell what the answer is when 4 ones are multiplied by 3. Direct attention to Picture C and get a child to explain that the hand is putting 10 of the 12 buttons into a box. Discuss the computation and let someone relate the large black 2 to the picture.

Page 143: Discuss Picture D, the text, and the computation. Let a child relate the text to the picture. Make sure everyone understands why the box of 10 buttons is being put aside.

Direct attention to Picture E, let a child explain what is happening, and call on another child to relate the brightly colored objects in the picture to the black figures in the computation. Make sure everyone understands that the large black 2 means 2 tens, or 20. In the same way, continue to discuss and relate Pictures F and G to their text and computation.

Page 144: Ask the children to read Problem A and ask questions to relate it to the picture. Let someone tell what the numbers in the equation stand for. Proceed to Picture B and relate text, picture, and computation. The children should answer the questions. Then direct attention to Picture C and let the children answer the questions and explain their answers. Have them relate what is happening in the picture to the questions and the computation.

Page 145: Pictures D, E, F, and G should be handled in the same way.

Page 146: In the work with the TRY step, individual differences among pupils will come to light. Pupils should work only as many of the examples as they need to before proceeding to the DO step, which offers no assistance but requires each pupil to work entirely on his own. Able students should work alone, but you should observe the work that is being done to make sure that pupils who consider themselves ready to proceed to the DO step really are able to do so. Slower pupils may need considerable attention here. Exercises A to P are to be used only if additional work is required.

Providing for the able pupil

Activity 36, described on page 351, may be used by able pupils with the following adaptations: Make sets of pink cards with random selections of numbers from 10 to 50, excluding the decade numbers (10, 20, 30, 40, 50). The winning score would then be within 50 points of 500.

Activity 9, "Target Toss" (page 335), may be adapted in this manner: Give each player 6 mason jar rings—either 2 each marked 1, 2, and 3, or 2 each of red, black, and white. When a player rings a number with one of his black rings (or one marked with the figure 1), he scores just that number and no more. If he succeeds in ringing a number with one of his red rings (or one marked with the figure 2), his score is twice the number he rings. If he succeeds in ringing a number with one of his white rings (or one marked with the figure 3), his score is three times the number ringed. Let several of the able children take turns being the official scorekeeper for this game. Each child should figure out his own score for his white or red ringers; the scorekeeper should total all the ringers for each player to see who had the highest score. The difficulty or ease of this game may be controlled by the size of the numbers you hang on the target hooks and also by the value you give the rings. Some pupils can work with multipliers greater than 2 and 3—with the multipliers 5, 6, and 7, for example.

Helping the slow learner

Activity 9, "Target Toss" (page 335), may be adapted for slow learners by keeping the numbers small. It may be advisable, also, to give each of these children only 4 rings—2 black (or labeled 1) and 2 red (or labeled 2).

147-153 Learning how

Lesson Briefs for this lesson are on pages 139-142.

Teaching the whole class

This lesson might be introduced by a discussion of puppets and puppet shows. Ask the children if they have ever been to a puppet show that was not a free show. Discuss how much tickets to various shows might cost. Then have the pupils open their books to page 147.

Page 147: Have the children read the statement at the top of the page. Then direct attention to Picture A and to the problem it illustrates. When the problem has been read, explain to the children that they do not need to answer this problem right away. Then ask a child to point out the 3 groups of 135 tickets. Call attention to the equation and text. Let a child tell what the 3 in the equation stands for, and relate it to the picture. Let someone else tell what the 135 in the equation stands for, and relate it to the picture.

Now direct attention to Picture B. Ask what the picture shows and why part of it is dimmed off. Let a child relate the text and computation to the action in the picture. Have him match the part of the picture in bright color to the black figures in the computation.

Treat Picture C and its text in a similar way. You might also ask such questions as:

Where did the tickets that are being made into a new bundle of ten come from? How many single tickets are left? What figure in the computation stands for these single tickets? What do you think we should do next?

Page 148: Have the children look at Pictures D, E, and F, relating each picture to the text and computation as they go along. When you discuss the large black figures in the computation opposite Picture E, make sure the children understand that the top 3 represents 3 *tens*. In discussing Picture F, let a child explain where the new bundle of 10 came from and let another child explain that 10 tens equal one hundred.

Page 149: Continue discussing pictures, text, and computation as you did for the two preceding pages. Bring out the relationship between each picture and its text, between the text and the computation, and between the computation and the picture. When you have worked through this page to the last sentence and the equation, have the children turn back to page 147, read the problem, and answer the question.

Page 150: Since this page begins the THINK step, lead the children into finding the right answers by asking any additional questions that seem necessary. Work through each picture and its text carefully, being careful to avoid direct explanation. Instead, encourage the children to do the explaining.

Page 151: Let pupils answer the questions as they work through Pictures C and D and the text. Make sure that for each picture everyone understands how the large black figures in the computation are related to the action of the picture.

Page 152: Continue working as before until the THINK step has been completed.

Page 153: Work through Problem A in the TRY step with the class and then let the children go ahead at their own rate of speed. Explain that if anyone is quite sure he understands how to do all the problems in this step, he may go on to the DO step. You will need to observe the work that children do by

themselves in this TRY section, to make sure that only those who really do know what they are doing continue to the next step, and also to find out which children need further help from you. Very slow learners may need considerable individual attention.

In the DO step the children should work entirely on their own. Provide a set of answers that they may use to verify their work when they have finished Problems A to D and Exercises E to T.

The final block of exercises (A to P) is intended for extra work, to be assigned if you think more practice is needed.

Providing for the able pupil

Activity 36, described on page 351, may be adapted for use with this lesson by making a new pack of pink cards that have three-figure numerals, such as 254, 121, 309, written on them. The game is then played as described. Pupils are to write an equation and do the computation for each three-figure numeral they multiply.

Activity 9, "Target Toss" (page 335), may also be adapted for use with this lesson. Hang three-figure numerals, such as those suggested in the above adaptation of Activity 36, on the hooks and put one-figure numerals on the rings. Players should compute the value of each "ringer" on paper.

Helping the slow learner

Activity 36 (page 351) may be adapted for use with this lesson by using on the white cards such numerals as 101, 120, 208, etc.

Activity 9 (page 335) can be adapted for the slow learners by using numerals like 101, 110, and 204. Use two numerals like these on the hooks and two-figure numerals (80, 71, 12, etc.) for the others.

154-156 Learning how; Keeping skillful

Lesson Briefs for these lessons are on pages 143-145.

Teaching the whole class

You can introduce this lesson by letting children tell about something they have done to earn money. In the case of children who have earned different sums of money over a period of time, ask how they could find out what the total amount earned was (by addition). Then ask if anyone has ever earned the same amount of money over a period of time, such as 5¢ a day for so many days, or 20¢ a week for several weeks. Ask what would be the quickest way of finding out how much was earned. Explain that today's lesson will show how to multiply numbers that mean dollars and cents. Then ask the pupils to open their books to page 154.

Page 154: Have the children read the problem and then look at the picture. Ask how many groups of coins equal to 35¢ each there are in the picture. Let children take turns counting the money in each group. You might also discuss the fact that, although each group in the picture contains the same amount of money, the coins in these groups are not all alike. Then discuss the reason for this (that the sums of money were earned in different weeks, and it is unlikely that Betty's mother would make up 35¢ in exactly the same way each week). Get the children to understand that the 35¢ in the equation represents the amount of money Betty earns each week—that the size of the group is 35. Also develop the idea that the 4 in the equation represents the number of groups because there are 4 weeks. Ask someone to explain what the screen represents in the equation.

Call attention to Picture B and ask a child to explain the meaning of the dotted background and relate it to the text opposite the arrow. Ask another child to read aloud the rest of the text opposite Picture B. Discuss the computation; have children multiply to see if the answer is correct. Explain that the idea is to learn how to do the work, and to do this they must check through for themselves the work shown in the book. Allow a child to count all the money in Picture B as a final check.

Direct attention to the text opposite Picture C. Ask why the 4 has no point or dollar sign. Explain that it is wise to write money with the dollar sign and point when we are going to compute, even though the amount is less than one dollar. Get the pupils to see the reason for this: we cannot be sure that the answer will not be more than 99¢ until we have computed, and we generally refer to money in terms of its largest units, such as one dollar rather than one hundred cents, even though one dollar means the same amount as one hundred cents. Ask someone to count the money in the picture and tell how much it is. Ask if it is the same money, that is, the same coins that are shown in 4 groups in Picture A. Also direct attention to the arrangement of coins (one dollar on the left and 40¢ on the right).

Page 155: Let children read the problem and relate it to the picture. (Each group of money in the picture should be counted.) Let a child read the equation and relate it, first, to the problem, and next, to the picture. The rest of the text consists of questions (or implied questions, such as a sentence or an equation with screens representing a missing number) which are to be answered by the children, preferably without assistance. If they need help, supply it in the form of further questions that will

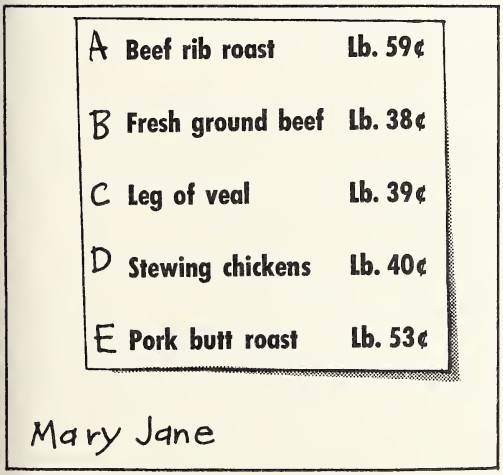
help them think in the direction that leads to the answer. After the final equation has been read, with the missing number supplied, have children count all the money in the picture, to see that it does equal $2.67.

Then let the children work on the TRY step by themselves. Note which children are working with understanding and confidence and which children are lagging behind the group. You may need to offer suggestions to slow learners to enable them to see their mistakes and correct them. As soon as a pupil feels ready to proceed to the DO step, where he will be entirely on his own, he should do so.

Page 156: Provide answers to the problems and exercises on a sheet of paper so that as students complete the DO step they may verify their work. (Exercises A to P are included as additional work, to be assigned if you think it is needed.)

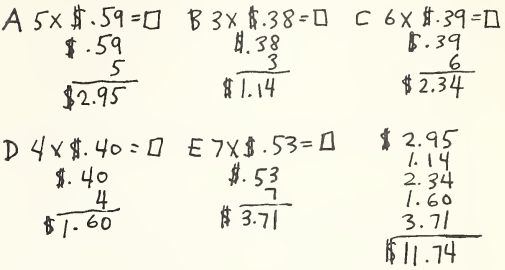
Providing for the able pupil

Have each child cut a grocery advertisement from a newspaper and paste it on a card. The advertisement should show at least four items for sale (more would be desirable) with the price per pound or item. Cross off any items that are beyond the scope of work covered thus far. Tell the child to letter each item A, B, C, etc., and to write his name on the card. A card might look like this:



In advertisements a small "c" is often used for the cents' sign. This should be explained to the children.

Put all the cards in a pile and let each child take one. Then tell him that he is to "buy" several (2 to 9) pounds or items of each advertised thing. He should "buy" a different amount of each thing. He is to make an equation and compute the cost of each thing on his paper. He should identify the computations with the letters on the card. The work for the card shown above might look like this:



Each child can also be directed to find the total cost of all the things he "buys." Then the children could exchange their cards with one another and continue working in the same way.

Helping the slow learner

Try to discover each slow learner's particular stumbling block, so that help can be given him according to his needs. Use coins or play money to make situations clearer.

157-158 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on poges 145-147.

Expanded Notes are not considered necessary for these lessons.

159-160 Moving forward

Lesson Briefs for this lesson ore on poges 147-149.

Expanded Notes are not considered necessary for this lesson.

161-164 Learning how

Lesson Briefs for this lesson ore on poges 149-152.

Teaching the whole class

The principal new idea needed in this lesson was taught on pages 159 and 160 (the multiplication of two-figure numerals by tens and hundreds). It is extremely important for the child to realize that in an example such as 13×26, when he gets around to multiplying by the 1 he is really multiplying by 10, and therefore his partial answer will be 260 and not 26.

The pictures in the SEE step suggest a convenient way of using objects to develop the lesson. You will

need 33 small boxes and 78 objects small enough so that 10 will fit into one of the boxes—for example, shell macaroni, corn, sunflower seeds, etc. Boxes might be empty match boxes, or boxes made of paper folded by the children. The numeral 10 should be printed on the bottom of each box to indicate, when the box is turned upside down, that the box contains 10 objects. To represent 10 tens, or 100, the boxes may be arranged in piles.

Page 161: One way of introducing this lesson is to ask children if they would be interested in planting seeds.

Then ask the children to open their books to page 161. Let someone read the problem aloud. Then direct attention to Picture A. Let children tell what they see in the picture. Ask how many groups of 26 seeds there are. Ask if there are as many groups of 26 seeds as there are children, and let a child identify the groups or explain their arrangement. Call attention to the equation and let children take turns relating each figure in it to the problem and to the picture. (You may need to explain that the 13 in the equation represents not the 13 children, but the 13 *groups of seeds* these children planted.) Be sure the children understand that they must think of the 13 groups as 10 groups and 3 groups and of the 13 as one ten and 3 ones.

Discuss Picture B and the accompanying text in the same detail. Draw attention to the fact that, since we are working with only 3 of the groups to start with, the other 10 groups have been dimmed off. Get the children to understand that the dotted background indicates that we are to think of the 3 groups of 26 seeds each as one total group, or as the seeds that 3 children planted. Then have someone relate the computation to the picture. Bring out the fact that in the computation, the 3 represents 3 groups of seeds and not 3 children, although it does represent the groups of seeds that 3 children planted.

If any child has difficulty understanding this step, let him work it through with objects. Use the pictures as a guide. Let him lay out 13 groups of 26 objects each, as shown in Picture A. (The arrangement of the individual groups of 26 into an overall grouping of 10 groups of 26 and 3 groups of 26 should be carefully followed.) Then let him combine the 3 groups of 26. When he does this, he will work with the ones first and will discover that he has more than 10 of them. Let him make a new box of 10 by putting 10 of the objects into another box. His arrangement would then look like the dimmed off part of Picture C on page 162.

Page 162: Let one of the children explain to the class what the dimmed off part of Picture C represents (the seeds planted by 3 of the 13 children). Let him tell where this number of seeds came from. Then have everyone read the text and ask why we are no longer concerned with this group of 78 seeds. Let pupils take turns relating to the text what they see in strong color in Picture C. Let someone explain the meaning of the dotted background. (The 10 groups of 26 each are to be thought of as a total group.) Have a child relate the computation to the text and let another child relate the computation to the picture. Be sure everyone understands that the 10 represents the 10 *groups of seeds* 10 children planted. Direct attention to the rearrangement of the 10 groups of 26 each in Picture D as 2 hundreds and 6 tens.

Again, slow pupils may need to work out this step with objects. However, since they had your attention during their initial arranging of the objects, they may be able to combine the 10 groups of 26 without assistance while you continue teaching the rest of the class. Explain to pupils working with the objects that when they have more than 9 tens, they are to make hundreds by piling boxes in groups of 10.

Be sure the children understand that Picture D shows the 78 seeds planted by 3 children (groups on the right) and the 260 seeds planted by 10 children (groups on the left). Now relate the computation opposite Picture D to the picture. Be sure to refer back to the computation opposite Picture B on page 161 and opposite Picture C to explain the numbers 78 and 260. Discuss the dotted background and its meaning. Relate the addition opposite Picture C to the picture.

Next tell the children that all the computation is usually written together in the same place to save work. Direct attention to the computation opposite Picture E. Draw attention to the figures in the computation, one under another, in columns representing ones, tens, and hundreds. Let the pupils look at the arrangements in the THINK and TRY steps.

Page 163: Devote some time to the picture, to start with. Draw attention to the 6 children at the upper part of the picture and relate them to the figure 6 in 26—in the problem, equation, and computation. Then direct attention to the 20 children in the lower part of the picture and relate them to the 20 in the 26. Let children read the text to discover how many seeds each child planted. Ask how many seeds there are in one group. Then ask why it is a good idea to think of the 26 children as 20 children and 6 children, and of 26 as 2 tens and 6 ones. Ask how many groups of seeds 6 children will plant and how many groups of seeds 20 children will plant. Ask how many groups of seeds 26 children will plant. If children are slow in answering, ask additional questions, such as these:

How many groups of seeds will 26 children plant? Do we know how many seeds there are in one group? Do we know how many seeds there are in 26 groups? What do we have to do to find out? Do we multiply the size of the group by the number of groups? What numeral represents the size of the group? What numeral tells how many groups there are? How shall we write these numerals in computational form? What numerals do we multiply first? What numerals do we multiply next?

Then let children take turns answering the questions in the text and relating the figures in the accompanying computation to the text as it is developed.

It is impractical to work this particular problem (or any other in which the multiplier goes into the second decade or higher) with objects, since it would require far too many objects. However, children who are still slow in grasping the process of multiplying one two-figure numeral by another two-figure numeral may use the objects assembled for the SEE step to work additional simple problems, such as 12×25, 14×17, etc.

Page 164: After discussing Problem A (in the TRY step) and its solution with the class, assign Exercises B to E as written work. Make sure everyone understands why no multiplying was done in the ones' column in Exercise B (because there are no ones in the multiplier). Tell the children that, when they do this work, they are not to look at the computation shown in the book until they have completed their own work.

Help those who fail to do the TRY examples successfully before permitting them to proceed with the DO step. Analyze the work of any pupil who is making errors to find exactly what the cause of these errors is, so that you can suggest the appropriate remedy. Perhaps some children will need to review the preceding lesson on multiplying by tens and hundreds.

Exercises A to T of the DO step are to be completed by pupils without any assistance from you. Provide answers for these exercises so that pupils may verify their work when they have finished the assignment.

Exercises in the second block (A to R) may be assigned to students who require extra practice.

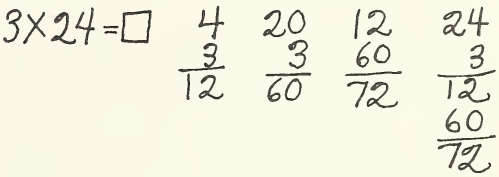
Providing for the able pupil

Able pupils can make up problems that require the multiplication of one two-figure numeral by another two-figure numeral, write them on cards, and exchange them with one another to solve.

Another activity able pupils enjoy is that of working with "magic numbers." Tell them to multiply 37 first by 3, and then by multiples of 3, as 3×37, 6×37, 9×37, 12×37, etc., as far as 27×37 to see what happens. (The products will be 111, 222, 333, etc., up to 999.) When they have done this, tell them to double 37 and to work with the result (74) in the same way. They should use the numbers 3, 6, 9, and 12 as multipliers. ($3\times74=222$; $6\times74=444$; $9\times74=666$; $12\times74=888$.) Then ask them to double 74 and find out how many times it can be multiplied by 3 or a multiple of 3 before the figures in the product become dissimilar. ($3\times148=444$; $6\times148=888$. Here the sequence ends, since $9\times148=1332$.)

Helping the slow learner

You may also give these pupils cards containing examples in which two-figure numerals are multiplied by decade numbers (10, 20, 30, etc.). Direct the children to estimate the answers in hundreds. For example, for 20×37 a child might write "700" if he thinks the answer will be in the 700's or he might write "800" if he thinks the answer will be in the 800's. The slow pupil may need further work with the multiplication of two-figure numerals by a one-figure numeral, simplified in the following way:



Later he can remember (or carry) the ten until he has completed the multiplication of tens.

Similar situations may be reproduced with objects.

165-166 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on poges 152-154.

Expanded Notes are not considered necessary for these lessons.

167 Keeping skillful

Lesson Briefs for this lesson ore on poges 154-155.

Expanded Notes are not considered necessary for this lesson.

168-169 Using arithmetic

Lesson Briefs for this lesson ore on poges 155-156.

Expanded Notes are not considered necessary for this lesson.

169 Checking up

Lesson Briefs for this lesson ore on page 157.

Expanded Notes are not considered necessary for this lesson.

CHARTING THE COURSE

Comparisons involving division

Arithmetic is often used to compare two groups of known size. If the groups are nearly equal, the process of subtraction is generally used to find how many more objects are in the larger group than in the smaller group, or how many fewer are in the smaller group than the larger one. Comparisons by this method were taught on pages 86 and 87. There are, however, many situations in which the difference between the groups is relatively large. For example, suppose one school has 448 pupils and another has only 64.

Comparison by subtraction shows there are 384 more pupils in the first than there are in the second, but this is not a very satisfying way of comparing the two groups. If the 64 pupils are considered as one group, one can ask how many groups of this size can be formed from the 448 pupils in the other school. This suggests a division, and $448 \div 64 = 7$. This result would usually be stated as follows: There are seven times as many pupils in the first school as there are in the second. In this situation, the result of the comparison by division is more satisfying than the comparison by subtraction. This will usually be true when one group is at least twice as large as the other.

Comparison by subtraction may be regarded as a special case of comparison by division. When the numbers are nearly equal, the smaller can be subtracted from the larger only once. In other situations where the smaller number can be subtracted from the larger more than once, comparison by division will usually be more satisfying.

Basically, the comparison can be made in two ways—either the larger group is compared with the smaller, or the smaller is compared with the larger. The latter comparison commonly leads to the language of fractions. It is, therefore, postponed until a later point in this arithmetic program. This discussion and the development on pages 170-173 of *Seeing Through Arithmetic 4* is confined to comparisons in which the base is the smaller group. Moreover, this development considers only those situations in which the size of each group is known. In these situations, the computation may be done by division, and the quotient is always larger than 1. The result of the comparison is then commonly expressed in multiplication language. For example, the statement may be "There are 3 times as many pigs as lambs."

Only an introduction to comparison by division is given on pages 170-173 of *Seeing Through Arithmetic 4*. There is a great deal more to be learned about this topic, but it must be deferred until a time when pupils have had a number of experiences that are essential to understanding it but which fall outside the normal scope of work for Grade 4.

170-173 Exploring problems

Lesson Briefs for this lesson ore on poges 158-160.

Teaching the whole class

Page 170: Social interest for this lesson is centered around a visit to a farm. Give the children opportunities to tell of their own experiences on farms before considering the arithmetic content of the lesson.

Have them open their books to page 170 and read Problem A. Then call on a pupil to identify in Picture A the group of 18 baby pigs and the group of 6 lambs. Be sure pupils understand what the 18 at the right stands for. Then ask the children how many lambs are in the smaller group. Tell them that there are 6 lambs and that we want to find how many groups of 6 pigs there are.

Direct attention to Picture B. Bring out the fact that the group of pigs in the black circle is equal in number to the group of lambs. Explain that all of the pigs are to be divided into groups of this number. Explain that this picture shows the beginning of the division of 18 pigs into equal groups of 6. Have the

children look at the beginning of the equation at the right of the picture. Get the children to understand that $18 \div 6$ indicates that the 18 pigs are to be divided into groups of 6.

The children should see that Picture C shows the group of 18 pigs continuing to be divided into groups of 6. Discuss the statement concerning the meaning of "how many times as many." Explain the completed equation.

Page 171: Let pupils look at Picture D and discover that the group of 18 pigs has now been completely divided into groups of 6. Call on someone to tell into how many of these groups of 6 the 18 pigs were divided. Then direct attention to the computation at the right. Tell pupils this merely shows what to do with numerals to get the answer to the problem.

Now take great care to develop the meaning of the special terminology involved in this type of problem. Ask the children if they have ever heard expressions like: "twice as many," "twice as long," "two times as many," and "two times as long." Let the children discuss such expressions as, "Jack had two times as many stamps as John had." Relate this type of expression to the work just completed.

Now tell the children that they will study another problem of the same kind. Have them read Problem A and identify the groups in Picture A. (Note that instead of explanations, the book asks questions that should cause the children to think through what must be done.) Reference to the pictures should help the children find the answers. Remind them that a wavy line (∽) indicates one or more missing words and that the screen indicates a missing number. Call on different pupils to tell the missing words and numbers and to answer the questions.

Page 172: Continue in the same way, having pupils use the picture to find the missing numbers.

Problem A on this page moves the pupils toward more abstract thinking. It is the first one without an accompanying picture. Have the problem read and discuss the equation carefully. You might ask a pupil to go to the board and draw 24 X's to show the yellow chicks and 3 squares to show the black chicks. Then ask him to illustrate the meaning of the problem and equation by drawing rings around groups of 3 X's. Be sure he knows why he draws rings around groups of 3. Ask another pupil to read the equation and fill in the missing number. Be sure the pupils understand the use of the idiom "8 times as many."

For Problem B, ask pupils to explain what the equation means [that 54 chickens are to be divided into groups of 9]. Let them explain the use of 9 and talk about using "6 times as many" because there are 6 groups of chickens. For Problems C and D, ask pupils to write the equation, find the answer, and be ready to explain their work by drawing pictures or using objects.

When you assign Problems E to N as written work, warn the children that they will find some other kinds of problems among them. Tell them to think about the problems very carefully to determine what is happening. Instruct the pupils to write the equation for each problem and find the answer; then rewrite the equation with the missing number in it.

Page 173: When the children have found the solutions to the problems in this lesson (E to N), supply answers (including the equations), and let each child verify his own work.

The "Keeping skillful" lesson should be treated separately. Have children copy the equations in Block 1 and supply the answers, or simply write the answers. The pupils should copy each exercise in Block 2 in computational form and multiply. Be sure they understand that either number may be used as the multiplier and that the sensible one to use is the one with fewer figures. In Block 3, they should copy the numbers in computational form and find the answers.

Providing for the able pupil

Before you begin this activity, discuss the kinds of situations in which things are divided into equal groups or in which things are compared by finding how many times as many there are of one as the other.

Write on the board several equations standing for divisive situations ($45 \div 5 =$ ▒, for example). Then ask the able pupils to write two different types of problems that fit each equation. They are to find the answer to each problem, too. The problem situations they write should be (1) those in which a whole group is divided into equal groups and they must find the number of equal groups and (2) those in which they must find how many times as many objects there are in one group as there are in the other.

Helping the slow learner

For any of the problems in the book that these children missed, let them use objects and set up the two groups for comparison. Instead of circling the equal groups in the larger group of items as was done in the book, have them separate the larger group into smaller equal groups.

174-175 Using arithmetic

Lesson Briefs for this lesson are on pages 161-162.

Expanded Notes are not considered necessary for this lesson.

175 Keeping skillful

Lesson Briefs for this lesson ore on pages 162-163.

Expanded Notes are not considered necessary for this lesson.

176-178 Exploring problems

Lesson Briefs for this lesson are on pages 163-165.

Teaching the whole class

The division problems on page 176 are of the type in which the size of the equal groups is known and it is desired to find the greatest number of equal groups of this size that can be made and the size of any remainder. On pages 118 and 119 children studied division of this type with remainders, but not in connection with problem solving. Before beginning the work on this page, you may find it worth while to review the work on those pages.

Page 176: Begin the work on this page by having pupils read Problem A. Tell pupils to look at Picture A, where they will see a box with 59 peaches in it (the children are not to count the peaches) and some smaller baskets that are to be filled. Be sure the children understand from the problem that 6 peaches are to be put into each basket. Then have them look at the equation below the problem. Let someone tell what the 59, 6, and screen represent.

Now direct attention to Picture B and the text below the equation. Emphasize the separation of the peaches into groups of 6. Then help the children understand that there will be as many baskets of 6 as there are groups of 6. Discuss the remainder of 5 and the reasons for not using another basket (the problem set up a requirement of 6 peaches).

Go on to Problem B. Have it read aloud. Let a child read the material labeled "Think" and supply the missing numbers. If he has trouble, ask him to think of the number near 27, but smaller, that can be divided by 6 without a remainder. Then ask him how much larger than that number 27 is. Let the child use objects to help visualize this division. Be sure that he associates the right number with piles and with cans in the last two statements.

Problem C, dealing with money, may be a little more difficult to think through. If possible, have 24¢ in pennies available. Make sure the children see that they must first find how many groups of 5¢ there are in 24¢ and that John can buy as many candy bars as there are groups of 5¢. Then let someone divide the pennies into groups of 5. Let the children pretend that some objects (pencils, chalk, etc.) are candy bars. Direct the child who separated the pennies to put an object (candy bar) beside each group of 5¢. Discuss the result (4 candy bars and 4¢ left over).

Page 177: Tell the children that on this page they are going to learn more about working with remainders, but that here the problems are of a different kind. Point out that on the preceding page they studied problems in which they had to find the number of equal groups and the remainders. Ask pupils if they can remember another kind of division situation (finding how many are in each group). Let them give examples and ask them if they can find the pages in their book on which they studied this type of problem (pages 120-123).

Make sure they realize that this type of division is concerned with finding the size of the equal groups. Then assemble 35 small objects and tell the children to pretend that they are pieces of candy. Ask someone to demonstrate how they can be shared equally by 5 children. Be sure he takes a group of 5 "candies" at a time from the original group and gives 1 piece of it to each of 5 children until all of the candy has been shared. Be sure the children observe that each of the 5 children sharing the candy gets 7 pieces. Next put the candies together again and include one more piece. Tell the pupils that now there are 36 pieces of candy to divide equally among 5 children. Help them share the candy as was done for the 35 pieces. Discuss the result (7 pieces in each of the 5 groups, or each of the 5 children received 7 pieces; remainder, 1 piece).

Ask the children to read Problem A and the equation to themselves. Pupils should look at Picture B and see that a group of 5 pieces of candy has been taken away and that each child has the first piece of his group of candies. In Picture C they should see that the division of candy has been completed—that the five boys each got 7 pieces of candy and that there is 1 piece of candy left over. Make certain that pupils can explain the equation given in the last line of the text—that they understand they can divide 36 by 5 because they take a group of 5 away each time each takes a piece.

If you think it advisable, work with objects when discussing Problems B, C, and D. In each case, get the children to explain each number and the screen in the equation. Also discuss what is meant by "Divide 37 by 6" (the 6 represents the group of cans needed to put 1 can in each pile), etc.

Page 178: Assign Problems A to F as written work. Warn the children that both types of division problems are included and that they must write the correct equation before finding the answer for each problem.

Supply equations and answers for the problems, and let the children verify their work. Then discuss the problems that caused the most difficulty.

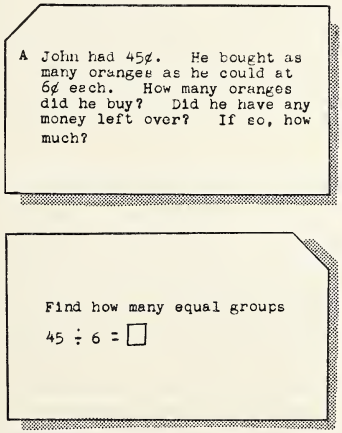
The material in the "Side trip" should be treated as a separate lesson. Review as much of the calendar as you find necessary, paying attention to the abbreviations for the days of the week, the sequence of numbers, the numbers of days in the months. Compare the displayed calendar for April 1947 with the current calendar.

Discuss Exercise A and note the two ways of writing this date. Discuss Exercise B. Assign Exercises C to I as written work.

Providing for the able pupil

Prepare a supply of cards (20 or more) with problems on them in which children must find either the number of equal groups and the number of remaining objects or the size of equal groups and the number of remaining objects. See Activity 13, page 337. The problems can be written on one side of the card or cut from discarded arithmetic books and pasted on the cards. On the other side of the card, write the description of the problem type ("find the number of equal groups" or "find the number of things in the equal group") and the equation. Label each card with a letter.

Let an able pupil take the pile of cards, read the problem on a card, and write the equation and the description of the problem. Then he should find the answer. He can verify his work by turning over the card. The picture below shows both sides of a sample card.


A John had 45¢. He bought as many oranges as he could at 6¢ each. How many oranges did he buy? Did he have any money left over? If so, how much?
Find how many equal groups
45 ÷ 6 = □

Activity 35, page 350, in which children are to make up problems for equations written on the board, may also be used by the abler children.

Helping the slow learner

Slower learners will need many opportunities to dramatize with objects division problems that have remainders in the answers. If they need this help, let them use objects in solving Problems A to F on page 178.

Try also to analyze their solutions to see where their weaknesses lie—in knowledge of the basic facts, in interpreting the problem situation, in dividing with remainders, or in interpreting what the remainder stands for.

179 Thinking straight

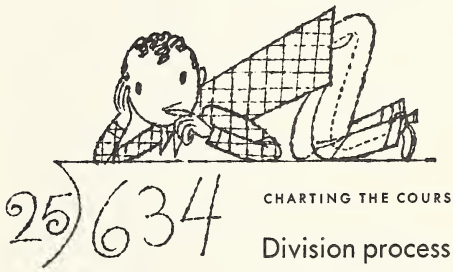
Lesson Briefs for this lesson ore on poges 165-166.

Expanded Notes are not considered necessary for this lesson.

180-181 Checking up

Lesson Briefs for this lesson ore on poges 167-169.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Division process

In *Seeing Through Arithmetic 4,* the learning of the division basic facts is based upon the quotitive or "measurement" type of divisive action. For example, the fact $54 \div 9 = 6$ is learned by observing (as on page 114) that when a group of 54 is separated into groups of 9, there are 6 such groups. The same basic idea is used to teach the process of division on pages 182-205. Division is taught as a process for finding how many equal groups of a certain size can be formed from a given group.

Division is generally regarded as the most difficult basic process in arithmetic. One reason for this is that, as usually taught, it is not a direct process, like addition or multiplication, and some estimating and adjusting are involved in all but the simplest of examples.

The quotient figure must be estimated step by step, and if at any step it is not "correct," a correction or new estimate is made, and the process continues.

Another reason is that for many years division with a one-figure divisor and division with a two-figure divisor were taught as if they were two quite different processes with little in common but three frightening words—dividend, divisor, and quotient. This was corrected (to some extent) when the use of "short" division as the introduction to the division process was abandoned in most schools.

A third reason is that the form in which the children were required to write their work when using the long division method made it almost necessary for them to have a high degree of skill and understanding before they could divide. There was nothing in the arrangement that would help to develop that skill and understanding. Furthermore, that method of writing long division forced the child to do a great deal of wasted work while he was trying and discarding numbers that might be part of the quotient.

Finally, no attempt was made to help the children understand division by showing them that it is really a process of repeated subtraction.

The computational process of division is based upon subtracting equal groups until the original number (or dividend) has been used up. This process is shown both pictorially and by symbols in this book, but at first no effort is made to subtract as many equal groups as possible. In an example like $54 \div 4$, the usual procedure consists of first subtracting 10 fours, or 40, and then subtracting 3 fours, or 12, to obtain a complete quotient of $10+3$, or 13, and a remainder of 2. However, one can subtract any desired number of fours (not more than 13, of course) in the first step. Thus, one can first subtract 5 fours, or 20, and then 8 fours, or 32 (as is done on pages 182-184), and obtain the quotient, 13, as the sum of 5 and 8.

This general understanding that the division process is accomplished by repeated subtractions is developed with great care. No new basic understanding is required when two-figure divisors are introduced (pages 200-205). In fact, the extension to divisors of three or more figures is immediate, but is not made in this book.

Much of the difficulty in division arises because it has been customary to insist that the pupil get the correct quotient figure in each step. Not even the most mature and skilled computers always get the right quotient figure on the first trial, but when the nature of the process is understood, they can proceed and correct their work. One procedure is to erase the work that was done with the incorrect quotient figure and start over. Another and simpler procedure is to continue the work and adjust the computation as one goes along. This procedure is used to introduce the process in this book. As children grow more mature and skilled in their work with division, they are taught gradually how to improve their estimates and are encouraged to do so. At the outset, getting the most economical estimate is regarded as less important than understanding the process.

In this book, the partial quotients are written at the right of the dividend, and a vertical line is drawn to separate them from the rest of the work. This arrangement makes it easy to add the partial quotients to find the complete quotient, which is written beside the remainder, if there is one. The complete answer is then in one spot. Writing the partial quotients in this way enables the child to add normally and to place his sum underneath the column.

For some forty years past in the United States, the conventional manner of writing division has placed the quotient above the dividend and used a horizontal line to separate them. This scheme has not always been used in this country and at the present time is not used in most other countries. The practice of placing the quotient at the right is not an innovation. It is a return to a practice that was formerly almost universal.

Certain details arising in the use of the process are given special attention. One of these concerns what to do when the estimated quotient is too large. This is taught in a "Thinking straight" section on page 192. Applications involving money are also given special attention. Some of the "difficulties" in division involving the placement of numerals, "bringing down" numbers from the dividend, and typical "zero difficulties" are largely avoided when pupils understand the division process. These difficulties arise when division is taught by reliance upon a set of rules ("divide, multiply, compare, subtract, bring down, etc.") which are learned without understanding. The painstaking pictorial development of long division in this book is designed to develop understanding as well as skill in the use of the process.

182-191 Learning how

Lesson Briefs for this lesson are on pages 169-175.

Overview

If you are not already familiar with the division method taught in this book, be sure to read the section "Charting the course" (pages 309-310) and then study pages 182-191 of the pupil's book. These ten pages provide an explanation that is simple, complete, and illustrated at every step. The general procedure taught here is a "long division" method that is the same for divisors of any size. It is introduced in this lesson with divisors of only one figure, but the method is general. Moreover, the first example (page 182) is one with a remainder, which is the general case. The lesson explains division as a process of repeated subtraction, and the reasons for each step are made clear by pictures and text. Finally, the difficulties of estimating the quotient figure are avoided, because neither the method nor the way the work is written requires that the exact figure be obtained before the work can proceed.

After examining pages 182-191 carefully, you should observe that: (1) the process makes use of repeated subtractions; (2) the complete quotient can be obtained in various ways, some of which are more efficient than others; (3) it is not necessary to learn and use the most efficient procedure at the beginning —efficiency can be built up gradually by the pupils; (4) the computation is written in a way that contributes to understanding.

Finally, note that this method does not lead to frustration through failure to estimate the correct quotient figure, followed by erasing and a fresh start which may again turn out to be "wrong." Also, at each step all of the partial quotient is written (for example, 60 and not just 6 in the example on page 191). Thus the question of where to place the "6" in the answer does not arise. Note, too, that on pages 200-205 the same method is used when the divisor has two figures.

In the first SEE step, on pages 182-184, two small partial quotients are used. These are totaled, and at the end of the step the equation is rewritten with the quotient and the remainder. In the second SEE step the same problem is used, this time with a larger partial quotient first. This example also ends with the partial quotients totaled and the equation completed. The child thus sees that one problem can be worked in several ways.

The THINK step is similarly adapted to the situation. One example is shown worked at different levels of skill—the lower first, then the higher. In the TRY step, where the child begins to work independently, each example is worked in four different ways, and in each case the way that demonstrates the highest level of skill is shown in red. The fourth, or DO, step provides practice. Most groups will need to use only the first block of examples (A to V). If additional practice is needed, the second block of exercises (A to T) may be used.

Teaching the whole class

Remind the children that they have already learned a great deal about division. If necessary, have them review the division basic facts and division with remainders (pages 55-65, 105-107, 114-117, 118-119, 176-178). Tell them that now they are going to learn how to divide larger numbers and how to divide when the answer has two figures.

Page 182: Have one child read aloud the problem beside Picture A. Have the children look at the picture and discuss it in terms of the problem. Be sure they realize that there are 54 bulbs in the picture and that these bulbs are going to be put in groups of 4. Have another child read the equation and explain what the numbers and the screen stand for.

Now have the children look at Picture B. Explain that the bulbs in the picture are the same as those shown in Picture A, but that they are dimmed off because something else in the picture is more important. Ask them how many pans of four bulbs each they think the fourth-graders can plant with the 54 bulbs. Get them to make quick estimates. Then guide the discussion somewhat as follows:

Let's find out exactly how many pans of four bulbs we can plant. How many pans are there in the picture? Let's start with those. Look at the numbers at the right again. The black 5 stands for the five pans in the picture. The red up-and-down line keeps the 5 away from the other numbers. Now look at Picture C. In this picture a group of four bulbs is in front of each pan. The picture shows that there are many bulbs left over. To find out how many bulbs are left, we must first find how many bulbs we have used.

Direct attention to the text at the right of Picture C. Have a child read the first statement; then have all of them look at the computation. Be sure they understand two things: the black 20 stands for the number of bulbs that have been used; it is written under the 54 so that we can subtract to find how many bulbs are left to be put in groups of 4.

Page 183: Point out that in Picture D the five pans of bulbs are dimmed off because we are interested in how many bulbs are left. Have the children look at the computation, which shows that 34 bulbs are left.

Summarize the work to this point by repeating that there were 54 bulbs to be put in pans in groups of 4 to a pan, that five pans have been filled and 20 bulbs were used to fill them, and that now there are 34 bulbs left to be put in pans.

Tell the children that some of the 34 bulbs that are left are going to be put in pans. Draw their attention to the eight new pans in Picture E and ask a child to read the statement beside the picture. Direct attention to the computation and point out that the black 8 stands for the eight pans that are to be filled, and that it is written under the 5 that stands for the five pans that are already filled.

Ask the children to look at Picture F and tell what it shows. They should observe that each of the eight new pans has a group of four bulbs in front of it. Have a child read the statement beside the arrow. Direct attention to the computation and have a child read the text next to it. Point out that the black 32 stands for the bulbs that are to be put into the eight pans. Be sure the children know that 32 is the total of 8 fours. Explain that 32 of the 34 bulbs that were left have been used, and that the 32 in the computation is written under the 34 so that we can subtract to find how many bulbs are left now.

Page 184: Have the children look at Picture G and describe what it shows (the five pans filled previously and the eight pans filled in the immediately preceding step, and two bulbs left over). Let one of them read the statement beside the arrow. Direct attention to the computation and go over the work just completed with the children. Remind them that the 32 stands for the eight groups of four bulbs that were just put in pans and that the 34 represents the bulbs that were left after the first five pans were filled. Let a child read the statement next to the computation and relate the computation to the statement and to the picture. Be sure all the children understand that the black 2 stands for the two bulbs that are left over. Ask if there are enough bulbs left to fill another pan. Explain that since there are too few bulbs left to fill another pan, the next thing to do is to find out how many pans in all have been filled.

Direct attention to Picture H. Explain that the five pans of bulbs that were filled first and the eight pans of bulbs that were filled next have all been put in one group, and that the dotted background behind the pans is there to help the children see them as one group. Have a child read the statements above the computation and relate them to the picture. Let the children count the pans, if they wish. Next direct attention to the computation. Ask what the black 5 and the black 8 stand for. Be sure the children think of them as representing five groups of 4 and eight groups of 4. Relate the addition of the 5 and the 8 to the picture. Be sure the children understand that the total stands for 13 groups of four bulbs, and that the remainder stands for two bulbs. Let a child read the completed equation.

Next direct attention to Picture A at the bottom of the page. Let someone read the first statement. Explain that these are the same bulbs and that they are going to be put in groups of 4 again, but that this time we are going to start with a different number of pans. Have the children observe the ten pans in the picture and read the statement under the equation. Point out that the black 10 in the computation stands for 10 groups of four bulbs, and that it is written in the same place that the 5 was written the first time the problem was worked.

Page 185: Get the children to observe that in Picture B a group of four bulbs has been put in front of each of the ten pans, and that some bulbs are still left over. Let a child read the statement beside the arrow. Have the children look at the computation and read the statements beside it. Be sure they understand that the black 40 stands for the 40 bulbs that have been used, and that it is written under the number that stands for the original number of bulbs. Explain that they are going to subtract the bulbs that have been used from the bulbs they had to start with to see how many have not yet been put in groups of 4.

Direct attention to Picture C and get the children to observe that the 40 bulbs have been put into the pans. Have them look at the computation and let someone read the statement beside it. Relate the black 14 to the 14 bulbs in the picture that are left. Remind the children that these bulbs must also be put in groups of 4. Then have them look at Picture D. Ask what the three empty pans in the picture are for. Have the statement beside the picture read and point out that in the computation the 3 that stands for the three new pans is written under the 10 that stands for the ten pans of bulbs that have already been used. Be sure the children understand that the 3 means 3 groups of 4.

Page 186: Get the children to observe that in Picture E, 4 bulbs have been put in front of each of the 3 empty pans. Remind them that they must find out how many more bulbs in all they are using. Let someone read the statement beside the first arrow and relate it to the 3 groups of 4 bulbs in the picture. Have the children explain the black 12 in the computation, and tell why it is written where it is. Be sure they know what the 14 stands for (the bulbs from which they took the 3 groups of 4 bulbs).

Direct attention to Picture F and have someone read the statement above the computation. Have the children look at the computation and relate the final subtraction to the bulbs in the picture. Ask if they should try to fill any more pans and let them explain why not.

Read the statement that accompanies Picture G. Get the children to observe that all the pans that were filled have been put in one group in this picture.

Let someone explain the computation and relate it to the picture. Be sure the children understand that the black 10, 3, and 13 in the computation all stand for groups of fours, and that the black 2 stands for the two bulbs that are left over. Let a child read the completed equation and explain how it tells what the problem asked them to find out.

Finally, ask the class to turn back to page 184 and look at Picture H. Let them compare the computation and the equation shown there with that shown for Picture G on page 186. Discuss with them the fact that both answers are the same, although the numbers of groups of 4 used were different. Explain that this problem could have been worked in other ways, too.

Page 187: The procedures described for the SEE step may be adapted for this problem. This time the children must answer questions and supply the missing numbers. Have them use the picture with each stage of the computation, and be sure they know which numerals stand for groups of 3, and which stand for number of bulbs.

Page 188: Continue the discussion of the problem begun on the preceding page, with the children answering the questions asked in the text and explaining the pictures and the computation.

Page 189: The first THINK step is concluded in Picture G on this page. Note that there is no remainder in this problem. Have the children explain why there is no remainder and bring out that this problem was worked in the same way as the one in the SEE step, where there was a remainder.

The second THINK step, beginning on this page, repeats the problem used in the first THINK step, with different sets of groups of 3. Have the children work through it in the same way, answering the questions and supplying the missing numbers. Remind them that a division problem can be worked in several different ways. Point out that this time the problem is solved in one step.

Page 190: As always in the TRY step, the children should work the problems independently and then compare their work with that shown in the book. Four solutions are given for each example on this page, at four successively higher levels of skill. The one that involves the greatest skill is printed in red at the extreme right of each series. Tell the children to write each example in computational form and find the answer, and then to compare their answer with that in the book. Tell them that although each *answer* must be the same as that given in the book, the numbers they use in finding it may be different from those in the book, since each example can be worked in a number of different ways. The children should realize that the example shown in red is the one that saves the most work in computation.

Page 191: The last example in the TRY step is at the top of this page. When the children have finished Examples A to D, discuss their work. Have them put some of the solutions not shown in the book on the board. Get the children to see that it is quicker and easier to use one or two larger partial dividends than it is to use many smaller ones.

Finally, let the children work the exercises in the DO step independently. Average groups should work only the first block of exercises (A to V). If more practice is needed, use Exercises A to T also.

Providing for the able pupil

Direct the abler pupils to examine Examples A to D, pages 190-191, and get them to note how many of the various partial quotients can be combined to get larger partial quotients. (Have them cover the red examples at the right when they do this.) In Example B, the two 10's can be combined to make 20; or the two 10's and the 20 can be combined to make 40.

When the children have done this for these four examples, tell them to examine their work for Exercises A to V in the DO step on page 191. For each exercise they should decide which of their partial quotients could have been combined into a larger partial quotient.

This activity will help them develop judgment and economy of effort in their work with division.

Helping the slow learner

There are several kinds of difficulties that the slower children may have. One is understanding the reasons for each step of the division process. Another is inability to do the necessary multiplication. If lack of ability to multiply is causing the trouble, have the children review the multiplication basic facts, especially for the higher numbers, and also review pages 140-141, which deal with decade multiplication.

A good technique for helping the slower children understand the division process is to let them work out problems with objects and write down what they do for each problem in the form of division computation. With some of the very slow children, it may be necessary to let them take out one group at a time

until they understand exactly what they are doing. Have them start with the problem in the SEE step on page 182, so that they can proceed from manipulating objects to the more advanced treatment of the same problem given in the book. Put 54 small objects to represent bulbs on a table and let one child take out successive groups of 4, while the other children watch and write the computation for each step. This should show them clearly the subtractive nature of the division process. Then suggest that two or three groups of 4 be taken out at a time, and again have the children write the computation. Let them do several problems in this way, if necessary. Most children will not need to start on such a primitive level, but will need to manipulate objects in small numbers of groups before they progress to solving division problems at even the simplest level of skill shown in the book.

192 Thinking straight

Lesson Briefs for this lesson are on page 176.

Expanded Notes other than provisions for able pupils are not considered necessary for this lesson.

Providing for the able pupil

Able pupils should be encouraged to improve their solutions of division problems by using larger partial dividends at each step, and fewer steps. Any of the following activities will contribute toward this end.

Make a set of 8″ x 10″ cards. On one side put a division example written in computational form and on the other put the answer. Arrange the cards so that the examples become progressively more difficult. Hold up the cards one by one and tell the children to look at each, decide what the answer will be, and write their estimates. Explain that, when estimating, it is better to give an answer that is a little too small rather than one that is a little too large. When you have shown five or six examples, show the answers. Let the children compare and discuss their estimates. Suggest to them that, in estimating, if they choose a number by which it is easy to multiply (such as a decade number), their work will be easier.

Then show another series of more difficult examples. Let the children compare their estimated answers to these examples with those for the first series and discuss whether or not their estimates have improved.

For more practice in estimating quotients, have the children pair off. Be sure that the children of each pair are of about the same ability. Give each pair a set of 3″ x 5″ cards with division examples in computational form on one side and the answers on the other. Have each child write his estimated answer. When the children are through, let them look at the answers on the cards and compare their estimates. This activity can be used independently by one or two pairs of children, or it can be used with the whole group.

After the children have had some practice in estimating quotients, you may let them have a spelldown. Choose two teams of children of about the same achievement level. Prepare a set of 8″ x 10″ cards on which division examples in computational form are written on one side and the answers on the other. The problems should all require approximately the same level of skill to solve. For example, none should have a divisor as small as 2, with a two-figure quotient; none should be more difficult than the examples the children have already worked. There must be at least as many cards with different examples on them as there are children, because no example should be used twice in the same game.

Show a card to the first child on a team and let him give an estimated quotient. This estimate must be less than the computed quotient or the same as the computed quotient. If the estimate is larger than the true quotient, the child is out. If the first child gives an acceptable estimate (one that is the same as or less than the computed quotient), show the same card to the first child on the second team and ask him if he can give a better estimate. If his estimate is closer to the computed quotient, the first child is out. If it is not, the child on the second team is out. If he accepts the first child's estimate, show him the second card and have him estimate the quotient; then give the second child on the first team a chance to accept or correct it. Continue the game, using the above procedures, until each child has had a turn, or until all the children but one are out. If a child is out because he overestimates a quotient, do not use that card for the next child on the other team, since he has a clue to the answer and has had longer to think about it. Be sure the children understand that they are not trying to give the computed answer to the example, but are just trying to estimate the largest first partial quotient they can. Give each child the same amount of time to give his answer. If a child does not answer in the allotted time, he is out, and the next card in the set is shown to the next child on the other team.

193-194 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons are on pages 177-178.

Expanded Notes are not considered necessary for these lessons.

195-197 Exploring problems

Lesson Briefs for this lesson ore on poges 179-181.

Teaching the whole class

You will find it helpful to have on hand 26 objects to represent apples and 160 pennies. (You may use either real or play money.)

The most important thing in this lesson is to develop a thorough understanding of the problem situation, so that the child may interpret his answer correctly after computing. At this stage in the child's knowledge, the only way he can work division problems that involve dollars and cents is to eliminate the decimal point and dollar sign while he is computing. This means that when he arrives at the answer, he is faced with the problem of what to call it. Shall it be cents, or dollars and cents? Does it represent objects or people? If there is a remainder, what does the remainder represent?

No child can answer such questions sensibly unless he knows from the beginning exactly what he is trying to find out. Frequently, however, what he is trying to discover, and does discover, through the computation, is the answer to a question that has not been directly asked. For example, the problem may put the question this way: "How many apples at $.06 each can Nancy buy with $1.60?" In order to understand this situation, the child must be able to relate the known and unknown quantities in it to the three parts of a division equation: the total amount, the size of the equal groups, and the number of equal groups. Before he can make the equation, he must decide whether the quantity to be found represents the size of each group or the number of equal groups. The form of the equation will depend upon whether the unknown quantity represents the number of equal groups (quotitive or "measurement" division) or the size of the equal groups (partitive division). When he computes to solve the problem mentioned earlier (quotitive division), he must also be able to make a correspondence in his answer between the number of equal groups he found and their use in the problem situation. (For example, the number of groups of $.06 contained in $1.60 corresponds to the number of apples Nancy can buy.)

If the child knows that the question "How many apples at $.06 each can Nancy buy with $1.60?" may be restated as "How many apples can Nancy buy with as many groups of 6 pennies as are contained in 160 pennies?" he will be able to make the correct equation, compute, and interpret his answer. In thinking out this problem, he will see that 6 pennies represent the size of the group, 160 pennies the total amount, and the unknown quantity (to be discovered through computation) the number of groups of 6 pennies that are contained in 160 pennies. He can then formulate the equation $160 \div 6 = \square$. When he finishes his computation, he will know that in 160 pennies there are 26 groups of 6 pennies with 4 pennies left over. Because he knows that the size of the equal groups (6 pennies, or $.06) is the amount needed to buy 1 apple, he should have no difficulty in interpreting his answer correctly as 26 apples (the number of apples that can be bought with 26 groups of 6 pennies), and the remainder will be seen as 4 pennies and not as 4 apples.

In *Seeing Through Arithmetic 3,* pages 92 and 93, children learned to make a correspondence between groups of money and the objects such groups of money would buy, or between groups of objects and the containers needed to hold groups of this size, etc. This work was reviewed on pages 66 and 67 of this book. If some children fail to make this correspondence easily in the problem on page 195, even after seeing it demonstrated with objects matched against groups of pennies, you may find it necessary to let them review these two earlier lessons. Have them match objects with pennies in very simple divisive situations with money until they understand the correspondence on page 195 between the number of groups of 6 pennies and the number of apples Nancy can buy.

In this book, the division basic facts were taught by means of the "measurement" or quotitive type of situation. In this situation, the relationship is as shown below.

$$\left\{\begin{array}{c}\text{number in}\\ \text{the total}\\ \text{group}\end{array}\right\} \div \left\{\begin{array}{c}\text{number in}\\ \text{each of the}\\ \text{equal groups}\end{array}\right\} = \left\{\begin{array}{c}\text{number}\\ \text{of equal}\\ \text{groups}\end{array}\right\}$$

$$\begin{array}{ccccc}\downarrow & & \downarrow & & \downarrow\\ \text{dividend} & \div & \text{divisor} & = & \text{quotient}\end{array}$$

The teaching of the division process also is based upon the "measurement" type of divisive action—that is, groups of known size (the divisor) are taken away, or subtracted, from the original group (the dividend).

The problem on page 195 is of the "measurement" type. When the amounts are expressed in pennies, the equation is $160 \div 6 = \square$, and the divisor, 6, is the number of pennies each apple costs.

In problems of the "sharing" type (partitive division), the situation is different, as is shown by the problem on page 196. In this type of problem the size of the equal groups (the divisor) is unknown. When the amounts are expressed in pennies, the equation is $160 \div \square = 6$. The 6 in this equation rep-

Expanded notes 192-194

resents the *number of groups* (of pennies), of equal but unknown size, that there will be after all the money has been shared by the 6 boys. There will be one group of pennies for each boy. In the computation, however, the divisor, 6, represents *the size of the group removed from the total supply* after each round of sharing. (Each time the 6 boys took a penny apiece, a group of 6 pennies was removed from the total amount to be shared.) As in the problem on page 195, the computation is used to discover how many groups of 6 are contained in 160.

The difference between these two problems lies in the meaning of the numerals and in the interpretation of the answer. This difference can be shown in a meaningful way by demonstrating these problems with objects. In the first problem, the groups of 6 that were removed from 160 remained intact, since the correspondence is 6 to 1 (6 pennies to 1 apple). But in the second problem, the groups of 6 that are removed from 160 are immediately partitioned among 6 boys, since the correspondence is 6 to 6 (6 pennies to 6 boys, or 6 pennies shared by 6 boys). In this problem, the answer (26 groups of 6 with a remainder of 4) represents 26 rounds of sharing. Since children can see, in a demonstration with pennies, that in one round of sharing each boy got 1 penny, they should recognize without difficulty that in 26 rounds of sharing each boy will get 26 pennies, and that 4 pennies will be left over.

You might introduce the work on page 195 by encouraging children to tell about their experiences in earning and spending money, and in sharing money. Then ask them to open their books to page 195.

Page 195: When the children have read the problem and have studied Picture A, let someone count the money in the picture and relate it to the money Nancy has. Then discuss the meaning of the numerals in the equation. Ask which numeral represents the total amount and have a child relate this numeral to the problem and to the picture. Ask which numeral represents the size of the equal groups. (You may remind the children, if you like, that in an equation, the numeral following the division sign always represents the size of the equal groups.) Let a child relate this numeral to the problem. Ask what the screen represents, and bring out the fact that since the numerals in a division equation always stand for the total amount, the size of the equal groups, and the number of groups (in that order), the unknown number must represent the number of groups. Ask why finding the number of groups (of pennies) will tell how many apples Nancy can buy. If you get no response, you might say something like this:

We know that $1.60 is the total amount. We know, too, that $.06 is the size of the equal groups. Do we know how many groups of $.06 there are in $1.60? Isn't that what we have to find out? Then isn't the number of groups—which we must find—the same as the number of times $.06 is contained in $1.60? That is, we must find one dollar and sixty cents divided by 6 cents. Why will finding this tell us how many apples Nancy can buy with $1.60? Is 6 cents the same as 6 pennies? How many apples can Nancy buy with one *group of 6 pennies? Can Nancy buy as many apples as there are groups of 6 pennies in $1.60?*

Ask a child how many pennies there are in one dollar and how many pennies there are in sixty cents. Then let him tell how many pennies there are in one dollar and sixty cents. Direct attention to Picture B and explain that it shows all the money in Picture A changed into pennies. Tell the children that when they compute with dollars and cents, they can omit the dollar sign and point from the computation if they think of all the money as changed into pennies.

Then direct attention to Picture C and ask why the pennies in the picture are being put into groups of 6. Let a child relate the 6 in the computation to the picture. Ask again how many pennies are needed to buy 1 apple. Let another child relate the 160 in the computation to all the pictures, to the text in Problem A, and to the equation. Let another child relate the 6 in the computation to the text in Problem A and to the equation. Have pupils verify the computation and explain the significance of the answer. Be sure they understand that the 26 represents the number of groups of 6 pennies that were contained in 160 pennies, and that 4 pennies were left over. Let a child explain how we know that these 26 groups of pennies will buy 26 apples. Let another child explain why the remainder, 4, means pennies and not apples.

Page 196: Have the children read the problem and pick out the numeral that represents the total amount. Help them see that the picture shows this amount. Ask what the screen represents in the equation. Ask where the numeral representing the size of the equal groups is written in a division equation. Ask if the number they must discover is going to be the size of the equal groups. Ask how we know that this number must stand for money and not boys or magazines. Ask the children if any of the numbers they know to start with in this problem are the same as the numbers they knew to start with in the preceding problem. Help the children discover the difference between these two problems. You may ask such questions as the following:

What were you trying to find out in the problem on page 195? What did you find when you computed? What did the answer to the computation tell you? Did you know how many equal groups there were? What did the 6 stand for? Is that what the 6 stands for in this new problem? What do you want to find out in this problem? Do you know how many equal groups there are? Do you know the size of each of these groups? What does the 6 stand for in this problem? What will it stand for in the equation?

Lead the children to see why the number of equal groups in the equation is the same as the number of boys. (When 160 pennies have been shared by 6 boys, each boy will have an equal number of pennies. Since there are 6 boys, there will be 6 equal groups of pennies.) Let the children discover that since we do not know how many pennies are going to be in each of these 6 groups, there is no way that we can make these 6 groups immediately with objects. Show children how these groups are built up gradually. The best way to show this is by a demonstration with 160 pennies (real or play money).

Choose six boys to act out the sharing process at a table where everyone can see what is happening. To start with, let the children count the pennies by tens to verify the amount. Then put all the pennies in a pile. Ask how the six boys can share these pennies equally. Someone will probably suggest that, to start with, each boy should pick up 1 penny. Let the boys do this and put their pennies in front of them on the table. Ask how many pennies were removed from the total supply when each boy took a penny. Put the problem on the chalkboard in computational form ($6\overline{)160}$) and explain that the divisor represents the group of 6 pennies taken away from 160 pennies in one round of sharing.

Let the children discover that they could go on taking out groups of 6 until all the pennies have been equally divided, but that it would take a long time. Ask for suggestions as to how the sharing process might be speeded up. Then have the boys put back the pennies they took and start over again, this time taking a larger group from the total supply. If you wish to have this demonstration follow the computation in the book step by step, tell the six boys to take 20 pennies apiece this time. Ask how many rounds of sharing this represents (how many times each boy got a penny). Then let the children see how many pennies altogether have been taken away from the total supply. If you like, you can write these numbers on the chalkboard, and later on let the children compare them with the computation in the book. Ask someone to count the pennies that are still left to be shared, and write this number on the chalkboard.

Suggest that the boys now take 6 pennies apiece from the remaining 40 pennies. Ask how many groups of 6 have been removed from the remaining amount, and how many rounds of sharing this represents. Ask how many pennies are left and if there are enough for another round of sharing. Remind the class that the boys first took out 20 groups of 6 pennies, and next 6 groups of 6 pennies. Ask how many groups of 6 they took out altogether. Let the children count the pennies each boy has now. Ask how many groups there are. Ask how many rounds of sharing this represents.

Next direct attention to Pictures B, C, and D and to the computation. Let the children take turns relating each picture to the computation. Copy the computation on the chalkboard and let someone explain the meaning of each numeral in it. Then go back to the equation and let a child read it, filling in the missing number and explaining what it means.

Slow pupils may need to go through a number of similar examples, taking out groups 1 at a time, then 2 at a time, etc., before going on to the problems on page 197.

Page 197: Discuss Problem A with the class. Let someone explain what would happen every time the 3 boys each took a penny. (A group of 3 pennies would be removed from the total amount.) Let the children tell what they know in this problem, as well as what they do not know and must find out. Let someone explain why 100 can be divided by 3 in the computation. Let a child show how to do this computation on the chalkboard and have another child explain what the answer and the remainder represent. If you think it is necessary, let three children use pennies and show what has happened.

Discuss Problem B in detail also. Have the children do the computation on their papers; then discuss the answer.

For Problem C, let the children tell what must be discovered by the computation, what the numerals in the equation represent, and why the number of groups of 8 pennies can immediately be translated into tablets after the computation has been completed. Let someone explain why the remainder cannot be translated into tablets.

Let children work by themselves on Problems D to K. Tell them to think about the problem, decide what must be discovered, write the proper equation, do the computation, and then rewrite the equation, filling in the missing number. Provide answers so that pupils may verify their work when it has been com-

pleted. Then note which problems proved to be the most troublesome, and discuss them with the class.

Providing for the able pupil

Activity 35, the "Make up a problem" game described on page 350, may be adapted to provide experience with partitive division involving money. Let the child who is "It" write on the chalkboard an equation with the first numeral in dollars and cents and with the screen following the division sign. Then the child he calls upon will have to make up a problem to fit the equation.

Helping the slow learner

Let slow learners make up division problems involving dollars and cents in which the size of groups must be found. Amounts used in the problems should be small enough so that the sharing action can be easily demonstrated with real or play money.

198 Keeping skillful

Lesson Briefs for this lesson are on pages 181-182.

Expanded Notes are not considered necessary for this lesson.

199 Using arithmetic

Lesson Briefs for this lesson are on pages 182-183.

Expanded Notes are not considered necessary for this lesson.

200-205 Learning how

Lesson Briefs for this lesson are on pages 183-187.

Overview

This lesson on dividing with a two-figure divisor is marked "optional" because this topic is commonly taught in the fifth, rather than in the fourth, grade. Any child, however, who can subtract with normal skill for fourth grade, and who can multiply by one-figure and two-figure numbers, can do the work on these pages. The logical time for children to begin work with two-figure divisors is immediately after they have studied one-figure divisors. Such a procedure rounds out and completes their knowledge of the division process. It also gives the children an opportunity to enrich their understanding of the process, and to generalize. Division with a two-figure divisor, as taught here, is not a new and more difficult form of division. The children are shown that the division process is the same when the divisor is a two-figure numeral as it is when the divisor is a one-figure numeral.

Teaching the whole class

Page 200: Before presenting the work in this lesson, you may wish to review multiplication by numerals ending in zero (this is taught on pages 159-160).

Let the class discuss the picture on page 200 in terms of the problem. The children should understand that the box holds 188 cookies, and that they are to find how many of the bags in the pile will be needed to hold the 188 cookies in groups of 12. When they are interpreting the equation, be sure they understand that the screen stands for the number of groups of 12 that can be made from the 188 cookies.

Remind the children that they have learned to divide with a one-figure divisor, and tell them that all division is done in the same way, no matter how many figures there are in the divisor.

Direct the children's attention to the first statement beside Picture B. Ask why 10 is a good number of bags to start with, and how they know that it will not take more than 188 cookies to fill 10 bags. Have them look at the computation, and ask someone to read aloud the statements beside it. Let pupils discuss whether or not this step is in any way different from the first step when they divide by a one-figure numeral. Ask someone to explain what the blue 188 stands for. Be sure the children understand that the black numeral 10 stands for 10 groups of 12 cookies each, and that the black 120 stands for the total number of cookies in the 10 groups of 12.

Let the children discuss Picture C and explain what it shows. They should observe the 10 filled bags, and mention that each bag contains 12 cookies. They should also observe that some cookies are left in the box, but that it is impossible to tell how many from the picture. Have them refer to the computation to find how many cookies are left.

Page 201: Remind the children that there are still 68 cookies to be put into bags. Have them look at Picture D and observe that five more bags are being filled. Ask why 5 is a reasonable number of bags to try to fill. Have the children explain the black numerals in the computation.

Next have the children look at the computation beside Picture E, observe the subtraction, and note that there is a remainder of 8. They should explain what the 8 stands for. Let them relate this numeral to the picture, which shows 8 cookies left in the box. Ask if any more bags can be filled with cookies and let a child explain why not.

Have the children examine and discuss Picture F. Remind them that they have been finding out how many bags of 12 cookies can be filled from the box

of 188 cookies. Let them point out in the picture the 10 bags that were filled first and the 5 bags that were filled next. Tell them that these two groups of bags must be combined to find out how many bags in all were filled, and point out the dotted background that helps them see the two groups as one. Direct attention to the computation and let various children explain again what each black numeral stands for. They should relate each numeral to the picture.

Page 202: Ask the children to read the problem at the top of the page and think about what the numbers and screen in the equation stand for. Have one of the children tell what the numbers and screen stand for. As you work through Steps A to E with the children, have them answer the questions in the text, verify each step of the computation, explain what the black numerals in each step of the computation stand for, and tell what the missing numeral is where there is a screen.

Page 203: Continue the procedures used with page 202 with Steps F and G at the top of this page. The children should understand what each black numeral in the computation stands for and should be able to explain what must be done with the partial quotients in Step G to find the answer. Have them read the equation, fill in the missing numbers, and explain what each number stands for.

The TRY step gives the children a chance to solve division examples and then compare their solutions with those given in the book. Tell them to write the numbers in Equation A in computational form and find the answer, and then to compare their work with that shown in the book. Make it clear that their work may differ step by step from that in the book, but the final answer must be the same. After they have tried the example, point out that the shortest and most efficient way of finding the answer is printed in blue, at the right of the page.

Page 204: Tell the children to work Examples B, C, and D as they did Example A on page 203. Remind them that when they finish each example, they are to compare their work with that shown in the book. Encourage them to work each example in the shortest way (shown in blue in the book), but do not insist that they do it this way. When the children have finished, discuss with them the various ways in which they worked the examples, and compare their solutions with the examples in the book. Also discuss each example shown in the book.

Page 205: Have the children work Problems A and B and Exercises C to R independently. When they have finished, let them show various ways of doing the computing on the board. Each child should be able to justify and explain his work. Exercises A to H may be used as additional practice.

Providing for the able pupil

The activities suggested under this heading in the Expanded Notes for pages 182-191 can be adapted for this lesson. The objective again is to acquire skill in estimating the largest possible partial dividend. Encourage the children to use decade numbers in estimating as often as possible.

Helping the slow learner

Since this work is optional in the fourth grade, it is probable that only the average and able children will cover this lesson.

206-207 Using arithmetic

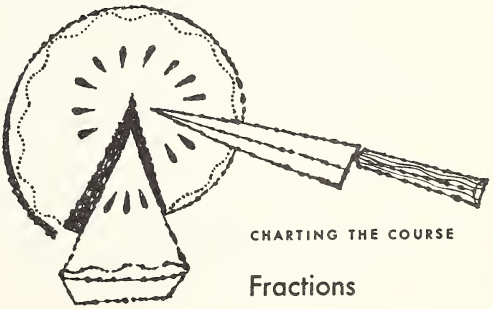
Lesson Briefs for this lesson are on pages 187-188.

Expanded Notes are not considered necessary for this lesson.

207 Checking up

Lesson Briefs for this lesson are on page 189.

Expanded Notes are not considered necessary for this lesson.



CHARTING THE COURSE

Fractions

In Grade 4, children are expected to become familiar with the kind of situation that leads to the idea of fractions. The basic concept of fractions involves the simultaneous use of two ideas. First, an object or a group of objects is partitioned into equal parts or subgroups. For example, a board is cut into 5 equal parts. In the fraction symbol, the denominator 5 represents the number of equal parts thus obtained. Second, a certain number (say 4) of these equal parts are selected for special attention. In the fraction symbol, the numerator 4 represents this number of parts. This involves thinking of both of the numerals together as one symbol.

These ideas are the basic meanings for situations that involve fractions. Here, as elsewhere, the child can best acquire these meanings by carrying out the actions with objects, and then using the number symbols to show what he has done. Pictures not only can help him acquire these ideas, but also can guide him to the actions that are basic to the meaning.

The concept of fractions is especially difficult for many children because the fraction numeral represents two ideas. There is the idea represented by the numerator alone (4 in the above example) and the idea represented by the denominator. The *Seeing Through Arithmetic* program for earlier grades has included an introduction to the fraction idea. In *Seeing Through Arithmetic 4,* these experiences are retaught and extended on pages 208-222. In Grade 4, however, the child is not expected to learn how to compute with fractions. As is customary nowadays, these computational processes are deferred to Grade 5.

In *Seeing Through Arithmetic 4,* common fractions with parts as small as sixteenths are considered. These fractions are presented not only in connection with single whole objects, but also with groups of objects. The idea of equivalent fractions is introduced pictorially. The number system is extended by including an introduction to improper fractions and mixed numbers. Fraction concepts are applied to measurement situations involving fractions of the inch. Finally, experiences are included to help the child avoid certain misconceptions that commonly arise when he sees fractions represented in only limited ways (for example, only as parts of circles all of the same size). As usual in this book, these lessons are built upon varied pictorial representations that are designed to develop insight and understanding.

208-211 Looking back

Lesson Briefs for this lesson are on pages 190-192.

Overview

In this lesson, children learn to use fraction numerals to represent parts of a thing or parts of a group of things. In *Seeing Through Arithmetic 3,* fractions through eighths were introduced. In this lesson, the ideas are extended to include fractions through sixteenths.

All the fractions introduced on pages 208 and 209 are illustrated, and, as usual, the parts of the illustrations not under consideration are dimmed off, leaving in strong color the fractional parts to be noted.

Teaching the whole class

You will want to give the children many opportunities to work with objects so that they can *see* fractional parts, can make them, and can express them meaningfully by fraction numerals. A flannel board is useful for such work and can be used to demonstrate to the class the meaning of various fractions. Activity 4 (page 331) includes instructions for making a flannel board.

Keep in mind that in this work on fractions, the size of the original group or the number of objects in fractional parts of the group is of no consequence. The only point to be emphasized is the number of equal groups.

Since this lesson is centered around woodworking activities, let the children talk about such projects and explain the objects shown in the pictures.

Page 208: Call attention to Picture A and ask such questions as these:

What is happening to the round board? Into how many equal parts is it being cut? In the third picture of the board, notice that part of the board has been dimmed off. The part of the board that the hand is removing is in strong color. How many of the parts are being removed? How many parts of the board were there in all? We can say that one of three parts is being removed.

Then have pupils read the text at the right and use the picture to verify what is said about the fraction numeral. Explain that the number words below show them how to read the numeral.

Focus attention next on the two scenes of Movie B. Point out that this time there is a group of objects (6 balls). Ask the pupils into how many equal groups the balls have been separated in the second scene. Get them to notice that they are to pay attention to only one of the three groups. Then have them read what is said about the fraction numeral at the right shown in large type.

When discussing Picture C, tell the children to imagine that the circular board has been cut into equal pieces. Then continue by adapting the questions suggested for the work with Picture A. Make sure the children understand that the top numeral in the fraction numeral is 3 because they are thinking of 3 of the equal parts into which the board has been divided.

Page 209: Questions suggested for use with Movie B and its text on page 208 may be adapted for Movie D. Point out that in this example 3 of the 4 equal groups are being considered. Help pupils note that

the fraction numeral 3/4 can stand for either 3 of the 4 equal parts of a whole thing (as in Picture C) or for 3 of the 4 equal parts of a group of things (as in Movie D).

Picture E and its text should be dealt with in much the same way as Pictures A and C on page 208.

Movie F and its text should be taught in the same way as Movie D. Again, have the children note that the same fraction numeral (2/5 in this case) can be used to stand for either a fractional part of a whole thing or a fractional part of a group of things.

Page 210: In working with Movies A and D, have the children look at the pictures and note the number of equal fractional parts each object has been divided into. They can then use the pictures to find the missing numbers in the related exercises at the right.

For Movies B and C, get the children to determine the number of equal groups into which each group of objects has been divided. When pupils find the missing numerals or words in the related exercises, have them point to the groups in the picture they are concerned with. Explain that the wavy line in Exercise E indicates that a word is missing.

In connection with Exercise I, let some of the children put on the board the 5 fractions and 5 whole numbers they selected to write on their papers.

Page 211: If you wish, discuss Pictures A to I with the class before assigning Exercises A and B as written work.

The children may need help with Exercises C and D. To help them see that one half dozen balls are more than one third dozen balls, draw one dozen balls on the board. Then show how to draw a line that will divide the group of balls into halves. Again draw one dozen balls on the board. Then show how to draw lines that divide the group of balls into thirds. Now, without regard to the number of balls in each group, the children should see that one half dozen balls are more than one third dozen balls.

In connection with Exercise D, draw on the board two sticks equal in length. Divide one into five equal parts and the other into six equal parts. Have the children compare one fifth of a stick with one sixth of a stick to find out that one fifth of a stick is larger. Remind the children that one half dozen is more than one third dozen. Help them see that when something is divided into more and more parts, the parts become smaller and smaller.

If you have a flannel board, you might use it to compare the parts of circles that are divided into thirds, fourths, and fifths. To do so, you will need three circular pieces of flannel of the same size, one cut into thirds, one into fourths, and the other into fifths. First put up the circle with three parts. Below this, or next to it, put the circles partitioned into fourths and fifths.

Each child also may have circles made of colored construction paper and divided into thirds, fourths, and fifths. By fitting the parts together to make circles, they will soon learn that, for example, it takes more fifths than thirds to make a complete circle.

To finish the work on page 211, have children read aloud the fraction numerals in Exercises A to R. Then assign Exercises A to L as written work. Let the children read and discuss the closing statement.

Providing for the able pupil

Able pupils might like to make drawings that show fractions. They may draw circles or squares and divide them (freehand) into equal parts. Later, the children should compare and discuss their drawings. No measuring should be permitted. Additional circles or squares may be drawn, too, with different parts shaded or colored to show different fractions. Instruct the children to write below each drawing a numeral to represent the fraction illustrated. Display the drawings in the classroom.

To get pupils to note applications of fractions around them, ask them to make a list of things showing fractions that they have observed. The list might include such items as fractions seen on measuring cups, half pound cartons, recipes, etc.

Helping the slow learner

To help slower learners understand the meaning of fractions better, you can let them work at the flannel board (perhaps assisted by an able learner). (See directions for making a flannel board in Activity 4, page 331). Provide 8 large equal circular pieces of felt or flannel. Leave one circle intact and put it on the flannel board. Then cut one circle into thirds, another into fourths, another into fifths, and so on. Mix up these pieces. Then instruct the children to build a circle showing thirds below the circle on the flannel board. The pupils will have to select the proper pieces from the pile and assemble them into a complete circle. Using the circle they have built, they can remove pieces to discover what 2 of 3 equal parts, or 1 of 3 equal parts look like. In the same way they can assemble other fractional parts of circles to show whole circles or fractional parts of circles.

As another activity, ask the slow learners to look for pictures that illustrate fractional parts. Let them show these pictures to the class and represent the fractional parts by fraction numerals if they can. The children may be interested in making a fraction picture book.

212-215 Moving forward

Lesson Briefs for this lesson ore on poges 192-194.

Teaching the whole class

As in the preceding lesson, let the children use a variety of ways to objectify the ideas presented. The flannel board may be used again effectively. Children can use circular paper cutouts and fold them in the ways suggested by the pictures in the book. For work with fractional parts of groups, children will profit if they have small objects which they can arrange and rearrange.

In this lesson, children learn that they can use different fraction numerals to describe part of an object or part of a group. On page 212 they are shown pictorially how some fractional equivalents for 1/2 are arrived at. The folding operations illustrated can be done by the children.

Page 212: For the work on this page each child may be given a circular piece of paper to fold in the ways suggested by the pictures and text. Such circles could be prepared by the children in advance by drawing around a small plate or a water glass or some other circular object.

Have the pupils first look at Picture A and note that the piece of paper is being divided into two parts. Let someone read the accompanying text, using the picture to answer the question and get the missing number. Then give each pupil time to fold his circle in half.

Continue in the same way with Picture B, this time getting the children to see that when the circle is folded again, it is then divided into four equal parts. Let them point out the four parts in the picture. Help them see that to fold their own circles into fourths, they must fold the half piece in half again. Tell them to open their circle and compare the folded sections with the circle in Picture B.

Pictures C and D and their accompanying text may be taught as above. The children may continue to fold their circles into the smaller fractional parts. Get them to conclude that 1/2, 2/4, 4/8, and 8/16 all stand for the same fractional part.

Page 213: For Pictures A to D, point out that the round piece of paper is divided by heavy lines into halves first and then into thirds. The dotted lines are further subdivisions of these fractional parts. Tell the children to examine the pictures and determine what the missing numbers should be.

Proceed in the same way for the remaining pictures on this page.

For an activity that will help the children consolidate what they have learned, give each child at least six strips of paper about one inch wide. Show them how to fold one strip into halves, another into fourths (tell them to fold it into halves first, and then into fourths), another into eighths, and others into thirds, sixths, and twelfths.

Let the children first of all compare their strips, noting those fractional parts that are equal. Then let them play a "trade me" game. For example, a child might say, "Who will trade me something that is equal to one half?" He chooses one of the offers and writes on the board what has been traded (1/2=2/4, for example). Let all the children take turns in trading.

Page 214: After pupils have read Exercise A, have them look at Picture A. Then have a pupil read the first sentence of Exercise B, and ask the class to note what has happened in Picture B. Call the children's attention to the fact that one half of the cups are black and red, while the other half of the cups are yellow and blue. Then call on pupils to read the remaining lines and supply the missing numbers. Use objects to clarify this, if necessary.

Continue in the same way for Picture C and its text. By noting the colors of the cups, the children can easily relate the fourths in Picture C to the halves in Picture B.

For Picture D, the children should note that now there are 8 equal parts. By referring back to similarly colored cups in Pictures C and B, they can find how many eighths are equal to one fourth and one half. Then let the pupils read and complete the text at the right.

With Picture E the pupils should see that the cups that were in groups of two in Picture D have been separated once more. Now there are 16 single cups. The children should use this picture and refer to the other pictures to find the missing numbers in the text at the right.

Page 215: Exercises A to O may be used for either oral or written work. For each exercise, pupils should determine what part of the circle or group of objects is red, and then supply the missing numerator in the fraction numeral below the picture. The more able children will benefit by also writing numerals to show what fractional part of each circle or group is some color other than red.

Exercises A to F may be used for oral work. If necessary, pupils may draw pictures to help them determine the relative sizes of these fraction numerals. Remind the children, too, that the more equal parts (of the same thing) there are, the smaller in size each part must be. This generalization should help them to figure out the answers.

Exercises A to N should be assigned as written work. Before the slower children do these exercises, let them try the activity suggested under the heading "Helping the slow learner."

Providing for the able pupil

When the able pupils have completed Exercises A to N on page 215, you might assign them similar exercises in which the numerators are more than 1. Such exercises might look like these:

Put in order, with the smallest fraction first:

A 3/4, 2/3, 2/4

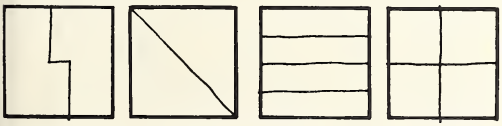
B 2/5, 3/8, 4/6

C 2/6, 4/9, 6/8

etc.

If the children need to, they may draw circles or squares to help them visualize the fractional parts.

The able children should also discover that a certain fraction of something (one half of a square, for example) is not confined to just one shape or position. It may have many different shapes and occupy different positions. To aid pupils in making this discovery, ask them to draw circles or squares of the same size and show different ways of making halves. The children may draw around jar lids or paper cups to make circles. Let the children show the different ways they discovered for making halves, and let the group discuss each to decide whether it is right or wrong. Then put the children on their own and let them divide circles or squares into thirds, fourths, fifths, etc. (Remember that these divisions are to be freehand, without measuring.) Some ways in which fractions might be indicated by the children are shown below. Be sure to display the children's pictures in the classroom.



Helping the slow learner

To help slow learners recognize equal parts of a whole and to give them more visual experiences with fractions, let them try the following activity. Cut tagboard into equal circular or square pieces. Make these circles and squares large enough so they will be easy to handle. Divide the circles and squares into different fractional parts (one into thirds, another into fourths, etc.). Mix up these pieces and give them to the group of children. Ask them to see how quickly they can assemble a whole circle or square. When the circles and squares have been assembled, have the children tell the fractional parts into which each was divided.

Exercises A to N on page 215 may give the slow learners some difficulty if used without preparation. Prior to this assignment, then, give these children an opportunity to work with fractions for which there are models. (If the flannel board has been in use, circles showing all fractional parts studied so far should already be available, or perhaps the children have made drawings of them.) Let the children work with the models and use them first to determine which fraction numeral in a set like 1/3, 1/4, 1/2 or 1/2, 1/8, 1/3 is the smallest. They then should arrange the rest in order from the smallest to the largest. Then give the children similar fraction numerals and ask them to put these fraction numerals in order (without models). If the pupils seem to understand the work now, let them proceed with Exercises A to N in the book.

216-219 Moving forward

Lesson Briefs for this lesson are on pages 195-197.

Teaching the whole class

Improper fractions and mixed numbers are introduced in this lesson. The children learn that both an improper fraction and a mixed number can stand for the same thing. Although the terms *improper fraction* and *mixed number* are not used in the text, you should use these terms in your discussions to prepare the children for their use in the future.

Page 216: Have pupils note the two whole cakes of the same size in Scene 1 of Movie A. Get them to observe that in the second scene each cake has been cut into fourths. Let someone state how many fourths there are in all. Then ask the class how many of the fourths are in strong color. (Remind the pupils that they are to pay special attention to the fourths in strong color.) If the answer is given as "5," guide the pupil to say it in the fractional way as "five fourths." Then explain that there is another way to say this. Point out that one whole cake and one fourth of the second cake are in strong color. Explain that "one and one fourth" also shows how much of the two cakes is in strong color.

Movies B and C should be treated in the same way. In each case, get the children to describe the parts in strong color by using both an improper fraction and a mixed number. For Pictures D, E, and F, explain that the cakes and the pie are shown only after they have been cut into equal pieces. Pupils should imagine what each cake and pie looked like before it was cut up. Then call on pupils to express in two ways what is shown in strong color.

If the flannel board is available, you may want to repeat some of these situations. For example, you may want the children to show Movie A by illustrating 5/4 and 1¼. A child will assemble four fourths to show one whole (4/4 or 1) and then will add another fourth to complete the illustration of 5/4 and 1¼.

Page 217: Call attention to Movie G and get the pupils to express the cut-up cakes in strong color as fourths. Explain that the fraction numeral and text at the right show how to write this fraction numeral. Let someone read the explanation of the two parts of the numeral.

Treat Movie H in the same way. After pupils have observed that 5 fourths are in strong color, get them to see that they can also think of the parts in strong color as 1 whole cake and 1/4 of the other cake. Direct attention to the text at the right.

Movie I can be taught in the same way as was Movie G.

Page 218: For Movie J, call attention to the whole cakes in the first scene. Ask what has happened to the third cake in the second scene and get pupils to see the number of equal parts it has been divided into. Then have them note how many parts are in strong color. Get them to explain that the second scene shows 2⅔ cakes in all. Have them read what is said about the mixed number 2⅔ at the right and note how it is written in words.

Exercises A to D are to be used with Pictures K to N. Each exercise is so written as to direct attention to the picture, and examination of the picture makes it possible to supply the missing numbers in the exercise. Be sure the children understand that the strong-color portions of each picture can be described by either a mixed number or an improper fraction and that the way we think about the picture determines the numeral we write.

Page 219: Discuss Picture A and help the children see that they can look at the two identical figures in two different ways. Have them note that one figure is completely red. Ask them to tell what part of the other figure is red. Ask them to tell what mixed number describes the red part of the two figures. Next have them determine that each figure is divided into 8 equal parts. Let them state the parts that are colored red as an improper fraction. For each of the remaining pictures, they should write on their papers the mixed number and the improper fraction that show how much is red.

Exercises A to G should be used for written work.

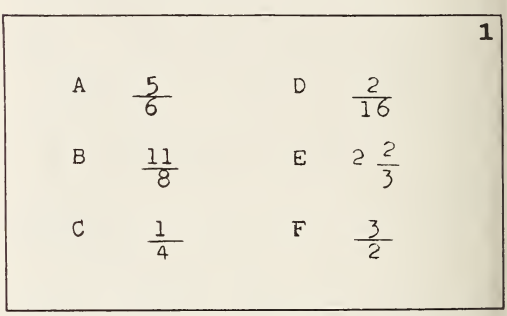
The children may take turns reading Exercises A to R aloud.

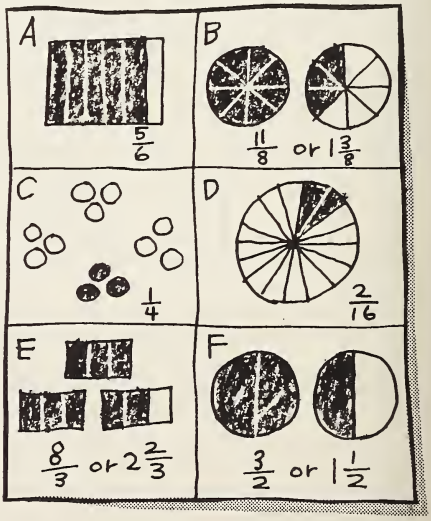
Providing for the able pupil

The "Fraction Maze," Activity 37, page 351, may be used to provide the children with experience in arranging mixed numbers in order from largest to smallest or from smallest to largest.

Helping the slow learner

Provide a supply of 3″ x 5″ cards, on each of which you have written six fraction numerals. Include common fractions, mixed numbers, and improper fractions. Letter each fraction numeral. Ask pupils to illustrate each fraction numeral. Under each drawing have them write the fraction numeral they are illustrating. A typical card showing six fraction numerals and a child's illustration of them are shown below. Be sure to display the drawings.





The game of "Fraction Maze," described in Activity 37, page 351, may be adapted for the slow learners' use.

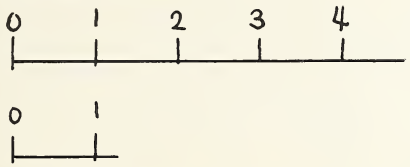
220-221 Moving forward

Lesson Briefs for this lesson are on pages 197-198.

Teaching the whole class

Although the pictures provide a number of measuring experiences, children will benefit greatly if they can also measure small objects with their own rulers. You might suggest that the children bring in small objects to measure. The graduation on the rulers used should show no more than eighths of an inch. If rulers showing inches were constructed in connection with the earlier measuring lesson, as suggested in Activity 1, page 330, the new graduations for parts of the inch can be put on them, and they can then be used with this lesson.

Before beginning the work in the book, you can explore the children's understanding of measurement by providing them with some lines to measure. Have these lines longer than a whole number of inches. Ask the children to place inch markings on the lines, as in the drawing below.



It would be well if the children used rulers with only inch markings on them.

Talk about how long the lines are ("a little more than 2 inches," "almost 2 inches," etc.). Then raise the problem of measuring the pieces that are less than an inch long. Some of the children may have rulers of their own that show graduations of an inch. Have them show these markings to the class and ask if any of them can tell about these markings. Then have the children open their books to page 220, where they can find out what the markings mean.

Page 220: After the class has looked at Picture A, showing 1 inch, have them note that in Picture B the 1 inch has been divided into two equal parts. Help pupils to see that each part is 1/2 of an inch and that the dividing line shows where 1/2 of an inch ends. They should see that 1 inch is two half inches, shown by the numeral 2/2.

For Picture C, let the children discover what has happened to each half inch. Have them tell the total number of equal parts now shown in an inch and read what is said beside the picture about the equal parts in the inch. Ask the pupils how many fourths there are in 1/2 of an inch. Then have them read the corresponding text at the right. Tell them that each dividing line now shows 1/4 inch.

For Picture D, get pupils to notice that each fourth has now been divided into two equal parts. Have them tell the total number of these equal parts in the inch and read what is said about the inch. Then have them tell the number of these parts in one half inch, and also in one fourth inch. Also have them read the text about these equivalents.

Tell the pupils that each dividing line now shows where lengths of 1/8 inch occur.

If the rulers suggested in Activity 1 (page 330) have been made, let each child now mark his ruler to show 1/2, 1/4, and 1/8 inch. The children may use the markings in the book to guide them. Be sure they note that lines of different lengths are used for the different markings.

If the children already have commercially made rulers with graduations to eighths, let them try the following activity. Have them draw 4 one-inch lines. Tell them to leave one line as it is. Then they should use their rulers and mark one line in halves, one in fourths, and one in eighths. Let them compare their work with the illustrations in the book.

After completion of either of the activities above, have children go back to the line measurements that were used to begin the lesson. Tell them to complete the measuring marks on these lines, putting in marks for one half, fourths, and eighths.

Pupils are to use the portions of rulers shown in the book to determine the length of each object in Pictures E to P. Explain to the children that many of the objects pictured are found on charm bracelets. After the pupils have taken turns in telling the length of each object, let the whole class write the result of each measurement on their papers after the appropriate letter. The children may also use their own rulers to measure these objects. Before they do so, be sure to discuss the things they have to watch out for when measuring with a ruler. Have them compare these measuring results with those they found when they used the portions of rulers.

Page 221: Have the pupils look at Picture Q and note that the key shown there measures 1 whole inch and a fraction of another inch. Help them determine that they must be concerned with the markings showing eighths and suggest that they count beyond the 1-inch mark by eighths to find how many eighths over one inch the key measures. Be sure they see that the total length of the key is 1⅝ inches. Ask them if they can discover another way to state this answer. Suggest that they find the total number of eighths

from one end of the key to the other. They should find that there are thirteen eighths and, consequently, that the key measures 13/8 inches. Continue with the remaining pictures in the same way. Then let the children do these exercises independently and record the results of the measurements on their papers. Finally, have them measure the objects with their own rulers and compare their results with those found when they used the portions of rulers supplied in the book.

Finally, draw attention to the 6-inch ruler at the bottom of page 221. Help the children conclude, by reference to their own foot rulers, that this is one half of a foot. Then let the children measure various small objects, either with their own rulers or by placing the objects along the ruler in the book.

Providing for the able pupil

Have these pupils arrange in order of length the objects pictured in E to H, in I to L, and in M to P on page 220. They should begin with the longest object.

Ask them to arrange in order of length the objects pictured in Q to Z on page 221. This time they may begin with the shortest object.

Helping the slow learner

If a child is having difficulty recognizing the various markings on the ruler, have him make a ruler showing only inch and half-inch markings. Then have him measure pictures and lines to the half inch. As he gains confidence in measuring by half inches, have him make fractional marks to show fourths. Then give him more measuring experiences that will involve measuring to fourths. Finally, let him put on the eighth-inch markings and measure with them.

222 Thinking straight

Lesson Briefs for this lesson ore on poge 199.

Expanded Notes are not considered necessary for this lesson.

223-224 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on poges 200-201.

Expanded Notes are not considered necessary for these lessons.

225 Side trip; Keeping skillful

Lesson Briefs for these lessons ore on poges 201-202.

Expanded Notes are not considered necessary for these lessons.

226-227 Moving forward; Keeping skillful

Lesson Briefs for these lessons ore on poges 202-204.

Expanded Notes are not considered necessary for these lessons.

228-229 Moving forward; Keeping skillful

Lesson Briefs for these lessons ore on poges 204-205.

Expanded Notes are not considered necessary for these lessons.

230-231 Moving forward

Lesson Briefs for this lesson ore on poges 206-207.

Expanded Notes are not considered necessary for this lesson.

232-233 Moving forward

Lesson Briefs for this lesson ore on poges 208-209.

Expanded Notes are not considered necessary for this lesson.

CHARTING THE COURSE

Averages

The idea of average is very widely used. Children in Grade 4 are old enough to understand it, and they need this understanding for use in work and play both in school and out. When learning to use averages, children are too often merely given a rule: Add the numbers, and then divide the sum by the number of numbers that were added.

Fundamentally an average is a single number that is used to represent a whole set of numbers. As a simple

example, consider what single number might be used to stand for the group of numbers consisting of 8, 12, 19, and 21. It is not immediately obvious that 15 is a good answer. If, however, the original numbers are thought of as measures of length (for example, the lengths of 4 sticks in inches), the total length would be 60. If this length were divided equally (that is, partitioned) among the 4 lengths, each would be 15 units long. Now the length of 4 sticks, each 15 units long, is "the same amount of stick" as the 4 sticks 8, 12, 19, and 21 inches long. Actually, the length 8 is 7 units under the average, and 12 is 3 units under it. Together, they are 10 units under the average. The length 19 is 4 units over the average, and 21 is 6 units over it; so together these are 10 units over the average. Thus the 10 units of shortage below the average are balanced by the 10 units of extra length above it. This will be true only when 15 is used as "the average."

When the meaning of average is understood as suggested above, finding the average may be seen as a two-step problem. In the first step, all of the measures are combined—this is an additive situation. The sum is then partitioned or separated into as many equal parts as there were measures originally. In some situations, the sum is already known, and only the partitioning remains to be done. In *Seeing Through Arithmetic 4,* pages 234-236 develop the idea of average so that children will be able to understand it as well as compute it.

234-236 Exploring problems

Lesson Briefs for this lesson are on pages 209-211.

Teaching the whole class

If not taught properly, the concept of average is a difficult idea for children to grasp. There is a real danger that children will learn the rule for finding averages without ever understanding what an average is. Help the class understand that an average is an imaginary amount. It shows the size of the group that would result if n unequal groups were put together and then divided up equally into n parts. The children should understand that an average is a single amount used to represent a group composed of groups of different sizes. Also, finding an average is a kind of equalizing process in which unequal groups become, in imagination, equal.

This lesson also will introduce pupils to the two-step problem, since the computation involved in finding an average usually requires two steps and hence represents two equations. First, there is an addition equation showing the amounts that must be added to find the total amount; and, second, there is a division equation in which the total amount must be divided into equal groups whose size is—to start with—unknown. The latter equation then expresses a problem in partitive division—partitioning—that will be solved in the usual manner. (Partitive division was taught on pages 120-123, and reviewed later in a money-sharing problem on page 196.) Note that in the explanatory text connected with the division equation on page 234, the association of the *number of groups* (of pennies saved in 6 weeks) with the *number of weeks* (needed to collect that number of groups of pennies) has already been made, since it is expected that by now the children will recognize this sort of correspondence immediately.

You should make clear to the children that the amount discovered to be the *average* need not correspond numerically to the actual size of any one of the groups from which the average is found. There may by chance be such a correspondence, as in the problem on page 235, in which the length of one of the fish is actually the average length of all the fish. In the problem on page 234, however, the average is not the same as any of the original groups of pennies.

Note the difference between the problems illustrated on pages 234 and 235. In the problem on page 234 the items are countable, but in the problem on page 235 the items cannot be counted, but must be measured.

Page 234: Let the children read the problem and then relate it to the groups of money shown in Picture A. Ask what we need to find out before we can begin to solve the problem (how much money in all Tony saved). Direct attention to Picture B and let the children relate the picture to the text and to the equation.

Direct attention to Picture C and let the children relate the picture to the text and the equation. Let a child explain why we can divide 54 by 6. Have someone read aloud the sentences at the bottom of the page. If there is any difficulty in understanding the problem, let the children work it out with pennies.

Page 235: Have the children read the text for Picture A and examine the picture. Tell the class to imagine that all the fish are laid end to end and ask how they could be measured to find their total length. Then ask how this total length could be found on paper. Let a pupil explain the two equations, and then have everyone do the necessary

computation for each equation. Have a child read the last sentence opposite Picture B, supplying the answer.

Let the children discuss Problem A and tell what equation to write first. Then have the pupils do the necessary computation. When they have done this, they will be able to make the second equation. Have them compute and give the answer. Have them answer the questions in the "Think" step. Handle Problem B in much the same way.

Page 236: Assign Problems C to J as written work. Warn the children that not all of the problems will require two equations. When these problems have been completed, provide answers so that the pupils may verify their work.

Providing for the able pupil

Get several different sizes of drinking cups and let children measure some liquid, such as water, to find the average amount these cups hold. An additional container, marked in ounces, is required. Children should fill all the cups, pour the contents into the container (which must be large enough to hold this much liquid), note the amount in ounces, and divide it by the number of containers. To make a two-step problem, let children measure the content of each cup in this way, record the result, add the individual amounts to find the total amount, and then divide to find the average.

Helping the slow learner

Let pupils measure strips of paper of various lengths and find the average length. Also, use pencils of various lengths, or vases, or boxes, or books of different heights. In each case, find the average length or height of the various objects in each set.

237 Side trip

Lesson Briefs for this lesson ore on pages 212-213.

Expanded Notes are not considered necessary for this lesson.

238-239 Side trip

Lesson Briefs for this lesson are on pages 213-215.

Expanded Notes are not considered necessary for this lesson.

240-241 Side trip; Keeping skillful

Lesson Briefs for these lessons are on poges 215-217.

Expanded Notes are not considered necessary for these lessons.

242-243 Using arithmetic; Keeping skillful

Lesson Briefs for these lessons ore on pages 217-218.

Expanded Notes are not considered necessary for these lessons.

244-248 Looking back

Lesson Briefs for these lessons ore on pages 219-222.

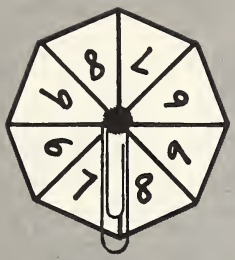
Expanded Notes are not considered necessary for these lessons.

249-251 Checking up

Lesson Briefs for these lessons are on poges 223-225.

Expanded Notes are not considered necessary for these lessons.

Activities

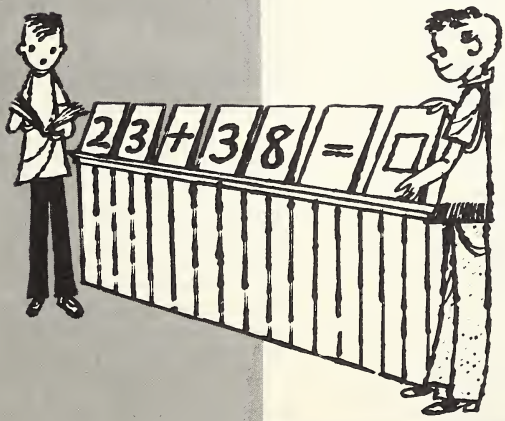


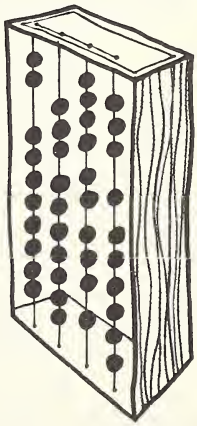
This section of the *Teaching Guide* contains suggested activities specially designed to extend the child's concepts and generalizations about arithmetic. Specific references are made to these activities in the Expanded Notes.

The activities are arranged in the order of their use in the Expanded Notes and are numbered to make reference to them easier.

You will undoubtedly discover new ways of using these activities and ways of adapting them to other topics.

You will also be sure to think up other activities as good as or better than the ones described here.

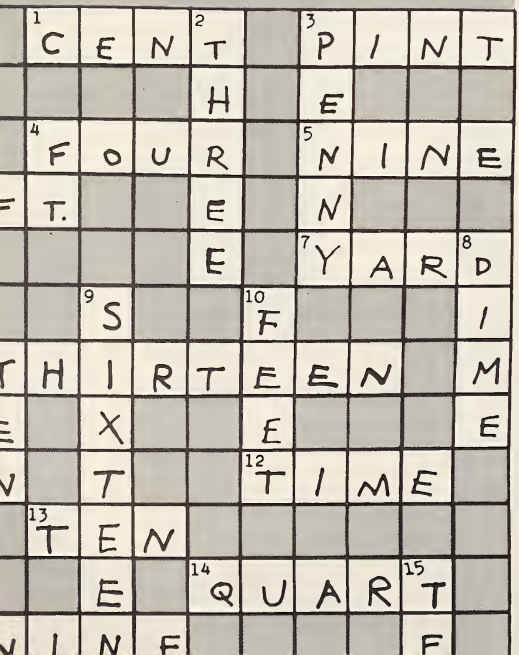




Activities

Useful arithmetic activities

are those that lead to good thinking and generalizations. They should not require time-consuming and mechanical work. They should be directly arithmetical.



Activity 1

Homemade ruler

Every pupil should have his own foot ruler so that he can participate in measuring activities. Rulers can be made of transparent plastic for those children who do not have real rulers. Provide some 12-inch rulers for the group and a strip of plastic (12″ x 1½″) for each child who is going to make a ruler. (Large sheets of plastic can be bought at most stationery stores and hobby shops.) Instruct the children to lay the strips of plastic over the marked rulers and make one-inch marks in the proper places, using India ink and a pen. Remind them to begin at the correct starting point. Later, when fractional parts of the inch are studied (page 220), the marks for fourths and eighths may be inserted.

Another way for the children to make the marks on their plastic rulers is to place a stick or other object that is one inch long on top of the plastic strip and make a mark at the end of it. Then they should move the one-inch marker to the right and make another mark, this time starting to measure at the mark just made. This procedure should be repeated until the end of the plastic ruler is reached.

After the children have marked their rulers in either way described above, the numbers may be inserted.

Activity 2

Reading and reporting

Reading to get more information about arithmetic ideas that are being studied and then reporting to the class on their findings will serve as an interesting and stimulating activity for able students.

At the fourth-grade level, some care must be taken that the material assigned is not too difficult. One book that able fourth-graders should be able to read the greater part of and report on is:

How Much and How Many
(The Story of Weights and Measures)
by Jeanne Bendick
Whittlesey House
McGraw-Hill Book Co., Inc.
New York, New York
Copyright 1947

Selected references from children's encyclopedias may also be used.

You will want to look over in advance any books that you intend to assign and devise some questions for the students to answer as they read. The questions should be arranged on cards according to topics. Place all questions relating to a certain topic and based on the same book on one card. Write the name of the book and the references to the pages on which the answers can be found at the bottom of the card.

Let each child choose the card he wants and find the book suggested. Tell him to read enough of the book to enable him to answer the questions.

Activity 3

Number along

Three to nine children can get practice in regrouping (as preparation for carrying) by playing this number game.

To prepare for the game, cut 3″ x 5″ cards in half to make 3″ x 2½″ cards. Decide on a series of numerals, such as 1 to 99, 100 to 199, 400 to 499, etc., and write each of the numerals in the corner of one of the cards. The purpose of the game is to get the ten cards for one of the decades (such as 10, 11, 12, 13, 14, 15, 16, 17, 18, 19; or 500, 501, 502, 503, 504, 505, 506, 507, 508, 509; or 710, 711, 712, 713, 714, 715, 716, 717, 718, 719). The child who gets such a sequence of ten first lays down his hand, calls out "Number Along," and wins.

To start the game, the pack of 100 cards is placed in the middle of the table, and each child takes a card in turn until he has 10 cards. Each player then looks over his hand to see if he has a start toward a sequence of numerals in any series of ten. If he does, he should save these cards and try to get the missing numerals in that decade. He must offer to trade a card that he does not want for an unknown one. If he cannot trade the card, he may discard it by putting it face down at the bottom of the pile in the middle of the table. He then draws a new card from the top of the pile.

The child at the right of the last player to pick up his tenth card to make his hand starts the game. He chooses the card he wants to trade and names the numeral on it by saying it in the form of tens and ones and arranging it so that there are more than 9 ones. For example, for the 42 card he would say, "3 tens 12 ones," "2 tens 22 ones," etc. If the player wants to get rid of a three-figure numeral, he must say it in hundreds, tens, and ones. The children who are saving "forties" will call out "here," and the first one to do so trades a card for the 42 card. If the player with the 42 card by mistake calls the numeral by its regular name, "forty-two," he loses his chance to get a new card. He must keep the old card that round. No player can lay down his hand of ten cards in sequence and call "Number Along" until it is his proper turn to play.

Activity 4

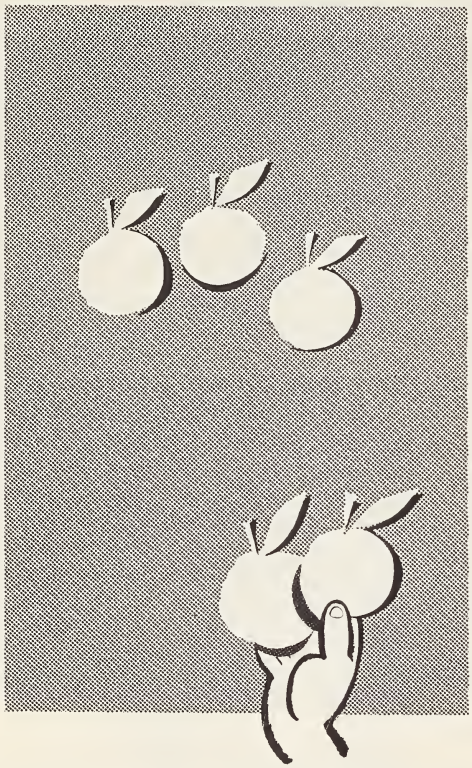
Flannel board

A sturdy felt board or flannel board is a very helpful device in the classroom, since it can be used many times throughout the year. Besides being a useful device for demonstrating the addition and subtraction basic facts and one-figure column addition, it may be used to provide experiences in the meaning and relationship of fractions and also in money equivalents.

Five eighths of a yard of 36″ flannel or felt, preferably a dark color, will be sufficient to cover a 24″ x 36″ piece of heavy cardboard or easelboard. Cutouts to be used with this board may be made of oaktag, felt, or colored construction paper. Small pieces of colored felt are sold in most hobby shops.

If you use oaktag or construction paper for cutouts, paste a small strip of coarse sandpaper on the back of each cutout. This will cause the oaktag to stick to the board when given a slight downward pressure. Cutouts of many different objects may be made—birds, apples, etc. Enough of each kind of object should be made so that the possible totals

reached by a combination of three one-figure numbers can be demonstrated.

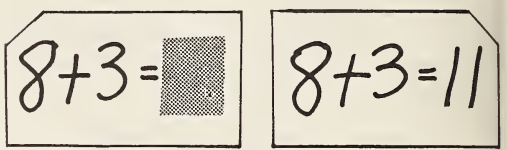


Activity 5

Trouble spots

Individual practice cards that contain only the basic facts the child finds difficult provide a stimulating activity. Let each child put the facts he finds troublesome on small pieces of drawing paper. Have him write the fact in equation form (without the answer) on one side of the card and the same fact in equation form with the answer on the other side. Lay the cards so that all the sides without answers are face up and cut off a small part of the upper left corners. The cut corners will help the child arrange the cards so that all the sides with answers or all the sides without answers are facing one direction.

Practice cards of this kind may be made for addition, subtraction, multiplication, and division basic facts. A pupil may use these cards in his spare time, working alone, or he may use them in practice sessions with a partner. As new basic facts present difficulty, new cards may be added to the individual packs. As soon as a pupil has learned a fact, he should remove its card from his pack. Encourage him to eliminate cards as quickly as he can.



Commercially prepared cards, for both individual and class use, are available (in computational form only).*

Activity 6

Get-a-row

"Get-a-Row," a game that provides practice on the basic facts, can be played by any number of children. The materials you need will depend on the practice you intend to give the pupils. For example, if practice on the addition basic facts for the 6 to 10 groups (sums from 6 to 10) is to be provided, you will need a master card for each player (see sample on page 333). The master cards should be 5″ x 5″ and divided into 25 squares. In each square write in equation form without the answer one of the addition basic facts for the 6 to 10 groups. No two cards should have the same arrangement of basic facts, nor should any basic fact be repeated on a card. Do not include more than five basic facts for the same sum on any one master card.

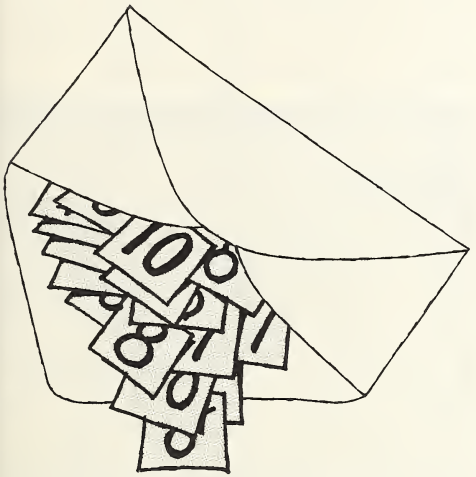
Answer cards that are slightly smaller than the squares on the master card should also be prepared. Each player will need 25 answer cards—5 for each of the numbers 6 to 10. The abler pupils can help in the preparation of these cards. Each set of 25 answer cards should be put in an envelope.

One child should be selected as the leader or announcer. He will need a set of cards showing the addition basic facts for the sums 6 to 10. The basic

*_Arithmetic Flash Cards for Individual Use_ (2″ x 3½″ in envelope); Set 5: Addition and Subtraction (200 cards); Set 6: Multiplication and Division (190 cards). Scott, Foresman and Company.

Arithmetic Flash Cards for Class Use (4″ x 7″, boxed); Set 1: Addition (100 cards); Set 2: Subtraction (100 cards); Set 3: Multiplication (100 cards); Set 4: Division (90 cards). Scott, Foresman and Company.

3+3	2+4	4+4	4+5	2+7
1+6	5+2	5+1	7+2	5+5
3+5	2+5	6+2	4+2	3+7
8+2	1+9	4+3	3+6	1+5
4+6	3+4	2+6	8+1	7+1



facts should be in equation form. One addition basic fact should be written on each card. Since there are 35 addition basic facts in the 6 to 10 groups, 35 of these cards must be prepared. If a set of basic fact cards such as those prepared commercially are available, select the 35 cards from the set.

To play the game, each child draws a master card and beside it places his 25 answer cards face up. The leader shuffles his pack of 35 basic fact cards and turns them face down in one pile. He then takes the top card and reads it without the answer. Each child looks over his master card for this basic fact; and if he finds it, he thinks of the answer and takes one of the number cards with that numeral on it and places it over the basic fact on the master card. The child wins who first fills correctly either a vertical row, a horizontal row, or the four corners and the square in the middle, or one of the two diagonal rows running from corner to corner across the center square. He must check his row of basic facts and answers with the leader's cards. If the leader arranges his cards as he reads them in rows according to number groups, he can check quickly the claims of the child who thinks he has won. One game may be continued until three or four children have won, and then a new game should be started.

This game can be adapted for subtraction basic facts with minuends of 6 to 10. For this game, each child will need a set of 35 answer cards (5 for each of the numerals 1, 2, 3, and 4; 4 for the numeral 5; 3 for the numeral 6; 2 for the numeral 7; 1 for the numeral 8).

A set of 35 basic fact cards for the subtraction basic facts for the 6 to 10 groups will be needed, like the ones used for addition. The master cards will be made with subtraction basic facts on them.

This game can be adapted for the addition and subtraction basic facts for the 11 to 18 groups also.

Activity 7

Double solitaire

The game of addition double solitaire can provide practice for two children in reviewing the addition basic facts for the 10 to 18 groups (basic facts whose sums are 10, 11, 12, 13, 14, 15, 16, 17, or 18).

For this game you will need these materials:

One set of 9 cards (blue, red, green, or pink) about 2½″ x 3″ (one 3″ x 5″ card makes two of them). Number these cards from 10 to 18 with large numerals. These are called "key cards."

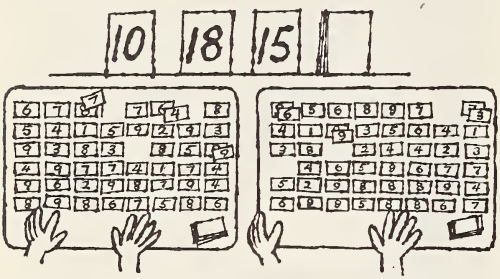
One set of 90 "solitaire cards" (white) about 1½″ x 2½″ (one 3″ x 5″ card makes four of them) for each player. Write large numerals on these cards as follows:

18 cards with the numeral 9
16 cards with the numeral 8
14 cards with the numeral 7
12 cards with the numeral 6
10 cards with the numeral 5
8 cards with the numeral 4
6 cards with the numeral 3
4 cards with the numeral 2
2 cards with the numeral 1

To play the game, give each child a set of 90 solitaire cards and place the set of 9 key cards on a table between the players. (Or the players may use their own desks.) Tell them to shuffle each set of cards, but to keep each set separate.

Each child should place in front of him 48 of his solitaire cards. These cards should be placed face up in rows, 8 horizontal and 6 vertical. Both players put aside the remaining 42 solitaire cards. Three of the key cards should be turned up and placed where both players can see them.

Each child then finds pairs of solitaire cards whose sums are equal to numbers on the key cards. He places one card of each pair on top of the other. For example, if the key cards are 10, 15, and 18, a player can combine cards whose numbers, when added, make 10, 15, or 18.



Each child plays independently and uses only his own cards. When the two players have made as many pairs from their cards as they can, they count the number of pairs. The winner is the child who has more pairs.

For a new game, put all 90 solitaire cards of one set together. Shuffle the set, take out 48 cards, and proceed with the game as before.

This game can be adapted to give practice in column addition. In this case, the children make sets of three solitaire cards whose sum equals the numeral on any of the turned-up key cards. The set of key cards should include a card for each numeral from 10 to 25. The winner is the child who has more sets of three cards.

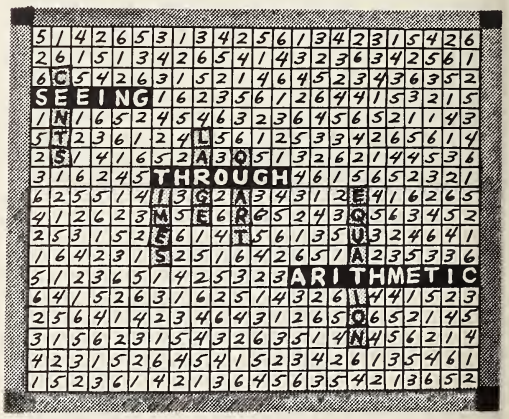
Activity 8

Number scrabble

This is a game that gives children practice both with column addition and arithmetic words.

To play it, a special board must be prepared in advance. It can be made of oaktag 24″ x 18″. It should be divided into 18 horizontal rows and 23 vertical rows. The words *seeing, through,* and *arithmetic* should be written on the board, one letter to a square, as indicated in the illustration below. In the remaining squares, put either one-figure, two-figure, or three-figure numerals, depending upon what addition you want the children to practice. The numerals need not be in any particular order. (The sample board shown is made with one-figure numerals.)

A variety of boards can be made by using such key words as *we, like, arithmetic* or *arithmetic, is, easy.* Children may enjoy thinking up slogans for the board. Variations in the board can be made by pasting these other key words over the words already on the board. Use a small amount of rubber cement so that the words can be removed easily. The board can be made more challenging by putting numerals like 12, 15, 18, 20, etc. at a premium distance above or below the key words. This will challenge the children to make larger words to achieve a much larger score by including the larger numerals. In placing the key words on the board, be sure to allow a sufficient number of spaces above and below for long words.



Two players can play the game, and each will need 98 small square pieces of cardboard upon which are written the letters of the alphabet. The two sets of squares should be different in color and should be slightly smaller than the spaces on the board. The number of squares for each letter will vary. They should be made in the quantities indicated below:

A—9	E—12	I—9	M—2	Q—1	U—4	Y—2
B—2	F—2	J—1	N—6	R—6	V—2	Z—1
C—2	G—3	K—1	O—8	S—4	W—2	
D—4	H—2	L—4	P—2	T—6	X—1	

The two players must first turn all of their letter squares downward. To determine which player will play first, have each child draw one letter. The child with the letter that comes earlier in the alphabet begins the game. Each child draws 15 squares for his hand. The player who starts the game looks at his 15 letters and the letters in the words *seeing through arithmetic* to see if he can build a word by using one of the letters in the words *seeing through arithmetic* and any number of letters from his hand. All of the words that the players build should be arithmetic words. The following is a sample list. Let the children add to this list as they think of new words or learn them in their work. Discuss the suitability of each suggested word for inclusion in the list.

add	fifth	mile	pint	sum
addition	fifty	minus	P. M.	tall
A. M.	five	money	pound	ten
big	foot	month	problem	three
bushel	forty	more	quart	time
cent	four	much	right	ton
cost	fourth	multiply	ruler	total
cup	fractions	narrow	seven	triangle
days	group	nine	short	twenty
dime	half	one	six	two
divide	high	ounce	sixteen	week
division	hour	paid	sixth	weigh
eight	inch	part	sixty	wide
equal	less	peck	size	yard
feet	little	penny	square	year
fewer	low	per	subtract	

After the child has put his word on the board, he picks up as many new letters as he needs to replace those he has laid down. If at any time he cannot make a word, he may add an ending, such as "-ly," "-s," or "-teen," to a word already made on the board, or he may draw one more letter. However, he must wait until his next turn to play it on the board. If, when it is his turn again, he still cannot play, he draws another letter, and so on. The players take turns until all the letters in the words *seeing through arithmetic* have been used or until the players have drawn all of their letters and cannot make another word. Once one of the letters in the words *seeing through arithmetic* has been used in a column to make a word, it cannot be used again even if there is space left above or below it.

When the game is finished, the players find their scores by adding the numerals on the squares that have been covered with letters. They can do this by adding each column and then adding the totals of all the columns. The winner is the player with the largest sum.

Activity 9

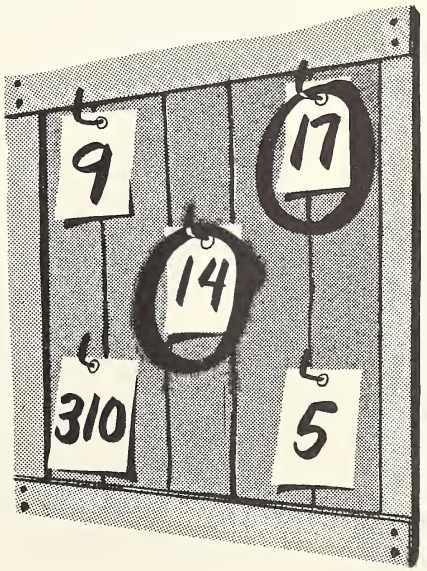
Target toss

The game of "Target Toss" can furnish practice in column addition of one-figure numerals, two-figure numerals, and three-figure numerals.

Materials needed are a large square board (or end of an orange crate), 5 drapery angle screws or hooks, 5 or more jar rubbers, and a set of large cards, each with a different numeral on it (one-figure, two-figure, or three-figure). Punch a hole in the top center of each card. Make the target by screwing the drapery hooks into the board or the piece of orange crate, one hook in the center and two rows of two hooks each, as shown in the picture below. Then hang a card on each hook.

The difficulty of the game may be controlled by the size of the numbers you choose to hang up and by the number of rings that are thrown. You can use all two-figure numbers or all three-figure numbers.

Decide before the game begins how many "ringers" a player may have at each turn at play. For example, the game can be limited to two ringers at each turn and a maximum of five jar rings to throw. When a player has two ringers, he is through for the turn. He may throw any number of jar rings up to five to get two ringers. The game can be made more difficult by requiring three ringers in 5 throws. If the children have difficulty getting two (or three) ringers, provide jar rings for more throws.

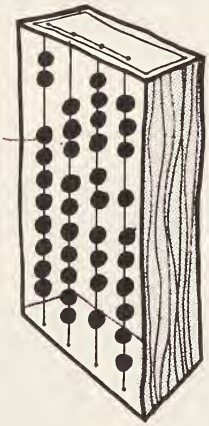


Let each player have a turn at throwing jar rubbers, one at a time, at the hooks from a distance of six feet. The numerals the player rings should be written by another child on the chalkboard under the player's name. Then let each player add up his own total score. The player with the highest total score wins.

Activity 10

Abacus

An abacus for adding and subtracting two-figure and three-figure numerals can easily be made. To construct a four-place abacus, you will need a cigar box, some heavy string or fine wire, and 40 small beads. Remove the lid from the box and drill four holes at each end of the box. These holes should be evenly spaced and near the top edge. Attach one piece of string or wire with 10 beads on it to each pair of opposite holes. (See illustration.) Be sure the string or wire is taut across the box. If possible, have beads with very small holes so that they not only can be moved easily on the wire but also will stay in the position to which they are moved. This abacus can be adapted to larger numbers by using more wires.



In using the abacus, the children should understand that the first row of beads from the right stands for ones, the second row for tens, the third rows for hundreds, and the fourth row for thousands. When they start to add, all of the beads should be at the top of the rows. The children should move them down as they add. Their knowledge of the number system should tell them that if all ten beads in one of the rows have been moved to the bottom of the wire, they can exchange them for one bead in the next row. For example, if all ten of the beads in the ones' row have been moved down, the children can move one bead down in the tens' row and move all the beads back up in the ones' row.

Suppose the children are adding 87 and 35 on the abacus. First they move 7 of the beads in the ones' row down to stand for the 7 ones in 87. They know that adding the 5 ones in 35 to the 7 ones gives them 12 ones, or 1 ten and 2 ones. So they then move back all of the beads in the ones' row except 2 to stand for 2 ones, and move down 1 bead in the tens' row to stand for 1 ten. Then they move down 8 more of the beads in the tens' row to stand for the 8 tens in 87; this gives them 9 tens. They then mentally add the 3 tens in 35 to the 9 tens. They know this gives them 12 tens, or 1 hundred and 2 tens. So they move up all but 2 of the beads in the tens' row (to stand for 2 tens) and move down 1 of the beads in the hundreds' row. They can then read their answer from the abacus as 1 hundred 2 tens 2 ones, or 122.

Now suppose the children want to subtract 29 from 74. First they move down 7 beads in the tens' row and 4 beads in the ones' row to stand for 74. To subtract the 9 ones in 29 from 4 ones, they must borrow 1 ten from 7 tens. They do this by moving one of the beads in the tens' row back up, leaving 6 tens. The children then must imagine they have 14 beads in the ones' row. When they subtract the 9 ones, they know there are 5 ones left. They show this by moving down one more bead in the ones' row, so that there will be 5 of them. They must now subtract the 2 tens in 29 from the 6 remaining beads in the tens' row; they do this by moving back 2 of the beads in the tens' row, leaving 4. The children can then read their answer from the abacus as 4 tens 5 ones, or 45.

Activity 11

Cork drop

"Cork Drop" is a game that will give children practice in adding two-figure and three-figure numerals.

The materials you need are an empty coffee can, or other similar container, and a supply of medium-sized corks. Write or paint a two-figure or a three-figure numeral on the top of each cork. Let each child have up to five tries at getting corks into the can. As soon as he has two in the can, he should look at them and add the numerals. Corks should all be dropped from the same height. (See illustration.)

Able students should use mental calculation in adding the numerals written on the corks dropped into

the can. Slow pupils should be allowed to use pencil and paper in adding their numerals.

The player with the highest total wins.

Provide enough corks so that children cannot become familiar with the number combinations that it is possible to make.

The difficulty of the game can be controlled by the size of the numerals on the corks.

Activity 12

Bean Bag

To give children practice in adding two-figure and three-figure numerals, a game using bean bags can be devised. Use a sheet of oaktag about 24″ x 36″. Divide it into nine rectangles by drawing heavy crayon lines. Within each rectangle write a two-figure or three-figure numeral. Have available four small bean bags for the children to throw.

To play the game, have children place the numbered oaktag sheet on the floor about six feet from them. Fasten it to the floor with tape. A small piece at each corner is sufficient to hold it. Each player should have four turns to throw. If a player's bean bag falls within a space, the numeral on the square should be written on the chalkboard by another player. If he succeeds in getting more than one bean bag in a space, the numerals should be placed in a column and added to find the total. Each player finds his own score. The pupil who has the largest sum wins.

A suggested layout for the board is shown in the drawing below. The rectangles can be drawn with chalk on the floor so that the numerals can be changed from time to time. If oaktag boards are used, several can be prepared with different sets of numerals on them.

218	97	431
194	900	25
611	542	356

Activity 13

Problem cards

To give the children practice in making equations for problems they are to solve, prepare some 3″ x 5″ cards (lettered A, B, C, etc.) with problems on them. Each card should have one problem written or pasted on it. You may make up these problems yourself or cut them from old textbooks. Be careful to select those that are easy for the child to read. Do not include problems beyond the range of the processes taught.

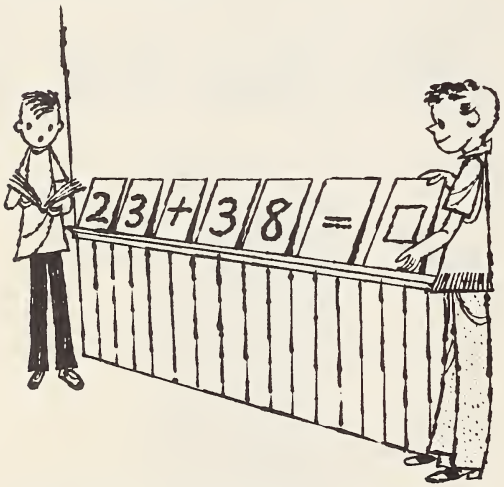
Let a pupil pick out three cards, five cards, or as many as you specify. On his paper, opposite the letter of each card, he is to write the equation, first with a screen or square in the place where a missing number is to be inserted, and then with the missing number

inserted. If a problem requires computation, the child should show his computation, then rewrite the equation, filling in the answer.

Activity 14

Setting up equations

In preparing for this activity, in which some pupils demonstrate equation-making for the rest of the class, you will need to cut some fairly large-sized squares of oaktag and write the numerals 0 to 9 on them. (Repeat each numeral two or three times.) You will also need to make a plus sign, an equals sign, and a screen on oaktag. Have someone read a problem from the text; then have one of the able students use the proper numerals and signs to set up the equation on the chalk ledge so that the whole class can see. See the picture below.



Activity 15

Always 10

The activity "Always 10" will give the children practice in adding and subtracting with two-figure and four-figure numerals. To furnish practice with two-figure numerals, provide the child with a card containing a series of six one-figure numerals. Tell him to make as many "Always 10" examples as he can. Explain that he is to use each of the six numerals only once in each example and that he is to make three two-figure numerals. The numerals should be arranged so that the final answer is 10 when two two-figure numerals are added and one two-figure numeral is subtracted from the sum.

For example, on a 3″ x 5″ card the six numerals 2, 3, 4, 5, 6, and 7 might be written. Following the instructions for the activity, a child could write these numerals on his paper and use them in this way to get an answer of 10:

54	32	24	34	42
32	45	53	52	35
86	77	77	86	77
76	67	67	76	67
10	10	10	10	10

On a second card write the numerals 8, 9, 1, 2, 3, 4, to be used in the same way. The following are examples that can be made with these six numerals.

83	81	28	38
21	23	31	21
104	104	59	59
94	94	49	49
10	10	10	10

On a third card write the numerals 1, 2, 3, 4, 5, 6, to be used in the same way. The following are examples that can be made with these six numerals.

51	53	25	35
23	21	31	21
74	74	56	56
64	64	46	46
10	10	10	10

This game may be adapted to give practice in subtracting four-figure numerals. To do this, use a series of numerals like 20, 30, 40, 50, 60, 70 or 80, 90, 10, 20, 30, 40.

The child is to put these numerals on his own paper in such a way as to get 1000 for an answer, as he did to get 10 for an answer in the exercises described above. For the first series of numerals, one possible solution might be as follows:

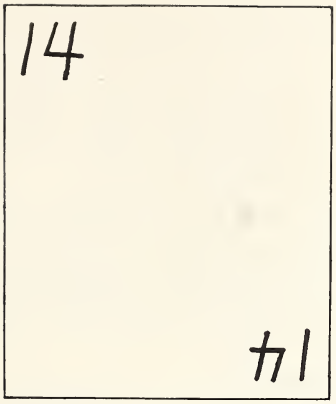
5040
3020
8060
7060
1000

Activity 16

Get 30

Four children may play this game.

Prepare four sets of 15 cards each. (3″ x 5″ cards may be cut in half.) Each card in a set should have one of the numerals from 1 to 15 on it. The numerals should be written twice on each card—upper left corner and lower right corner. (See illustration on page 339.)



The four sets of cards should be shuffled together. Then from the 60 cards, one child gives 9 to each player, including himself. The remaining cards are kept in a pile (face down) on the table and drawn, one at a time, as the game proceeds.

The object of the game is to get rid of all the cards in the hand by combining 2, 3, or 4 cards that total 30 and laying them down.

The first player draws a card from the top of the pile and examines the cards in his hand to see if he can make any groups of 30. He lays down any such groups he has, then discards a card from his hand and puts it at the bottom of the pile on the table (face down). A card should be discarded whether he lays down any groups or not. But if a player can "go out" by laying down *all* of his cards, he need not discard one. When a player has "gone out," scores must be figured for that deal as explained in the next paragraph.

A bonus of 50 is given to the player who "goes out" for each deal. A player's score is the total of the 30's he has put down, plus the bonus (if he "goes out") and minus the total of the cards remaining in his hand. If the total of the cards remaining in his hand is greater than the total of cards that he has laid down, his score is 0. Encourage the children to multiply 30 by the number of groups to get their scores. For example, Susan held these cards in her hand when Helen "went out": 5, 14, 6, 2, which is a total of 27. She had laid down 3 groups of 30. Her score for one deal was 90 minus 27, or 63.

Keep the scores for each deal and compute the final scores for a complete game after every player has dealt once. The player with the highest total is the winner.

Activity 17

1089

This activity can be used to provide able pupils with practice in adding and subtracting three-figure numerals. Have the children select a three-figure numeral in which the difference between the hundreds' figure and the ones' figure is more than one (306, 589, 723 will do, but 685, 132, or 708 will not do).

Then have the children make a second numeral by transposing the hundreds' figure and the ones' figure in the original numeral. Now direct them to find how much larger one numeral is than the other.

For example, suppose someone chose 965. He would make as a second numeral 569. The difference is 396. (This is the third numeral.)

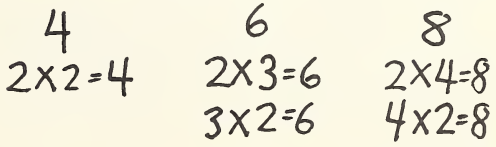
Now direct them to make a fourth numeral by transposing the hundreds' figure and the ones' figure in the third numeral. Tell them to add these two numerals (the third and fourth). Suggest that they make several examples and note the final answers. The result will always be 1089, no matter what number they choose, provided the original number meets the requirements.

Children will not only enjoy trying this out many times themselves, but they will also enjoy using it as a trick example on their friends—one in which they can "tell" the answer before they see the final computation.

Activity 18

Multiplication and division basic fact lists

To give children a review of the multiplication and division basic facts in a different way, have them arrange the facts according to number groups. For this activity, instruct the children to write the numbers 4, 6, 8, 10, 12, 14, 15, 16, 18, etc. (including only the number groups they have studied), in rows across the top of their papers. Show them how to leave sufficient space between and below numbers so that they can write the complete equations in a column under each number. (See the sample below.)



This activity may be used for the division basic facts also. Instruct the children to put the dividends for the division groups across the top of their papers in the same way. Then tell them to show in equation form all the basic facts that belong in each group. For the 4, 6, and 8 groups, their work would look like this:

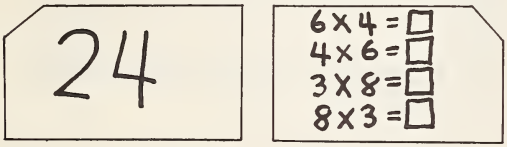
4	6	8
4÷2=2	6÷2=3	8÷2=4
	6÷3=2	8÷4=2

Activity 19

Multiplication and division basic fact practice cards

As a follow-up to Activity 18 or as a separate activity, have the children make practice cards for the multiplication and division basic facts. They may use the lists made for Activity 18 to make a card for each number group. Each card should have a group number on one side and all the basic facts for that group on the other side.

The practice cards should be made of oaktag. A sample card for the 24 group in multiplication is shown below.



Arrange the cards with the group number face up, and cut a piece from the upper left corner. Then the cards can be assembled easily with the group number up.

In using the cards, children may work individually or in pairs, reading the group number first, then trying to say or write all the multiplication basic facts that give that answer. By reversing the card, they can verify their work. New cards may be made as higher number groups are studied.

When the abler children have successfully gone through all the facts in this way, they might give their cards to the slow learners and supervise their work with the cards.

Similar cards can be made for the division basic facts.

Activity 20

Multiplication and division "tables"

Another way to review basic facts is to have the children make their own "tables." For multiplication, have them start with a number representing the size of the equal groups and show how the answers (products) change when this number is multiplied by successive numbers. The children should make one or more of these tables, but make them only as far as they have reviewed the basic facts. As new facts are reviewed or learned, they can be included in the appropriate table. A sample table is given below.

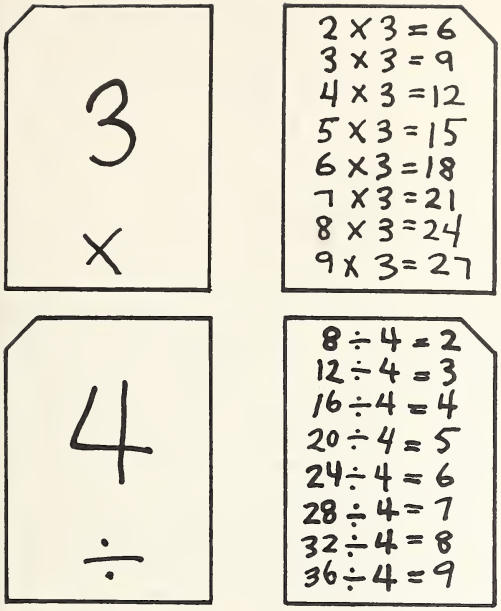
2×2=4	4÷2=2
3×2=6	6÷2=3
4×2=8	8÷2=4
5×2=10	10÷2=5
6×2=12	12÷2=6
7×2=14	14÷2=7
8×2=16	16÷2=8
9×2=18	18÷2=9

For division tables, have the children take a number representing the size of the equal groups (divisor) and show how the answers (quotients) change as increasingly larger numbers are divided by this number. Have them use number groups only as far as they have studied or reviewed. See the sample table above.

Activity 21

Multiplication and division table cards

For a more permanent record, the tables made in Activity 20 may be transferred to small oaktag cards. For multiplication, have the children write the number representing the size of the equal groups (multiplicand) on one side of the card. The basic facts using that number should be arranged in table form on the other side of the card to show how answers (products) change when this number (multiplicand) is multiplied by successive numbers.



These cards may be used individually for oral or written work. The equations on the back provide the children with a means of verifying their work.

Division cards may also be made. The number representing the size of the equal groups (divisor) should be written on one side of the card. The basic facts should be arranged in table form on the other side of the card to show how the answers (quotients) change as increasingly larger numbers are divided by this number.

Activity 22

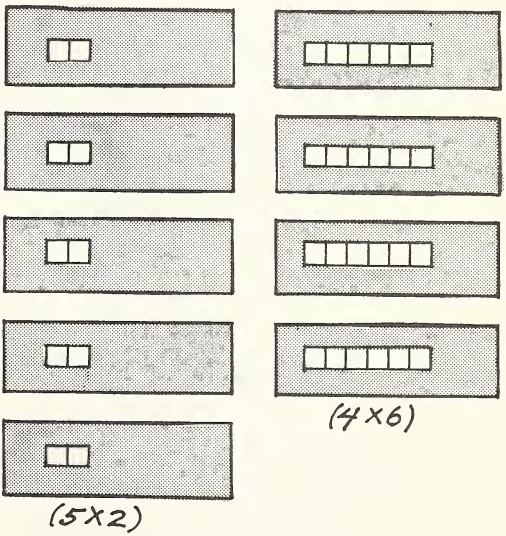
Multiplication builders

To give children more opportunities to visualize the multiplication basic facts, sets of cards can be made for illustrating the products which result when equal groups of numbers combine according to the multiplication basic fact equations.

Each card contains amounts of squares equal to a numeral between 2 and 9. The squares should be at least one-fourth inch on a side. Graph paper with these squares ruled on it can be bought; or tablet paper, already ruled horizontally, can be ruled into squares by drawing vertical lines on it.

The children can cut rows of squares, as described here, and paste each row on a card. The cards should all be the same size, and large enough to accommodate the longest row (9 squares). 3″ x 1″ will be adequate if the squares are cut from graph paper. Each set of 81 cards should include 9 cards for each numeral 2 through 9. There should be 9 cards with a row of 2 squares, 9 with a row of 3, etc.

One way to use the cards would be for a child to assemble cards for the basic facts that cause him trouble. For example, he would assemble 5 cards with 2 squares each for 5×2 and 4 cards with 6 squares each for 4×6. Another way to use the cards is to let two children work together—one assembling the cards for a basic fact, such as 7 cards with 3 squares each, and the other saying the basic fact for the card ($7 \times 3 = 21$).



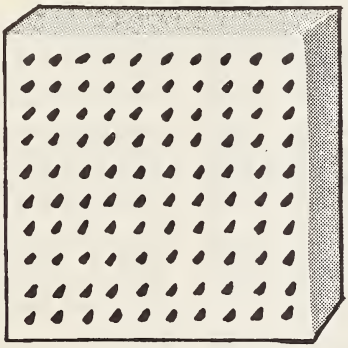
Activity 23

Hundreds' board

Some children will be greatly helped in learning the multiplication basic facts and the multiplication of decade numbers through 10 tens, and will gain a better understanding of the commutative law (the reverses, $4 \times 6 = 24$ and $6 \times 4 = 24$), by working with a Hundreds' Board. Such a board can be permanent equipment on a classroom wall. Children can use the board to show such basic facts as 5 sevens, 7 fives, 8 nines, 9 eights, 2 tens, 10 twos, 8 tens, 10 eights, 3 twenties, 20 threes, etc.

A peg board can be made of perforated wallboard, an inexpensive material which is sold in hardware stores, lumber yards, and some department stores. Perforated wallboard comes in thicknesses of ⅛″, ¼″, or ½″, with holes punched at intervals of either ½″ or 1″. Dealers who carry perforated boards of this type will also supply various types of hooks or pegs to be used with it.

Another type of board, equally sturdy, can be made of plywood, with 100 nails (or screws or pegs) permanently fastened to make 10 rows of 10. If you use such a board, you will also need 100 objects, such as tags, disks, or small spools, to put on the nails. Put the nails or pegs far enough apart to provide space for spools or other identifying objects.



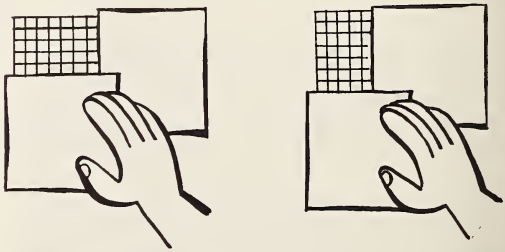
If you use a type of board having holes already punched and select removable pegs to go with it, you will not need any additional equipment.

Suppose you wish to use the Hundreds' Board to show the reverse facts 5×7 and 7×5. First, have the children make 5 groups of 7 by putting pegs (objects, if you are using the plywood board) on the board in 5 horizontal rows of 7. (Objects would be put on nails or hooks in the plywood board; pegs would be inserted in the holes of the peg board.) Then, to show the reverse fact (7×5), have the children remove the first set and make 7 horizontal rows of 5. The basic fact may be written on the chalkboard at the same time.

So that the children may have individual "peg boards," you might supply each child with several sheets of paper on which the Hundreds' Board square (10×10) has been duplicated with X's as shown in the picture at the top of the next column. These sheets can be easily made on the typewriter with hektograph carbon and duplicated. Or give each child sections cut from squared paper, containing 10 rows of 10 squares each.

Each child should have several pieces of oaktag that are the same size as the Hundreds' Board square. He can use these to cover X's so that a desired basic fact is displayed on the individual "peg board" of X's. For example, the child can show 5 sevens by placing the pieces of oaktag on one copy of the "peg board" so that 5 sevens are exposed as a group of 5 rows of 7.

On another copy of the "peg board" he can show 7 fives in 7 horizontal rows similarly blocked off by the markers. The pictures below show how to use squared paper to illustrate basic facts.



Activity 24

Multiplication and division chart

A chart for the multiplication and division basic facts can be prepared as a class project for review and to provide a permanent chart for reference and display purposes in the classroom. A chart like this contributes to generalizations about the processes that the child should make.

You will need to prepare these materials in advance: a large sheet of oaktag divided into 9 horizontal rows and 9 vertical rows of spaces; numerals 1 to 9, which may be cut from calendars or written on paper squares. Twenty of the numeral 1 will be needed, and the others in these quantities: 25 twos, 13 threes, 21 fours, 13 fives, 15 sixes, 6 sevens, 13

eights, 4 nines. The numerals should be small enough so that two of them can be placed side by side without extending beyond the dimensions of one of the spaces on the chart. The children can help prepare these numerals. The numerals may be written with a felt pen.

When the sheet of oaktag has been divided into 81 spaces, put it on a bulletin board at a height that every child can reach. The numerals should be placed in piles near by and arranged with the 1's in one pile, the 2's in another pile, etc.

Direct a pupil to thumbtack in the top horizontal row of spaces the numerals 2 to 9. He should start with the second space from the left. Have another pupil thumbtack in the first vertical row at the left, going downward, another set of the numerals 2 to 9. He should start with the second space from the top. The upper left space is blank.

Then ask pupils to look at the 2 in the row at the left and the 2 in the top row. Ask them what 2×2 is. When the answer has been given, let someone take a 4 from the supply of numerals and thumbtack it in the space under the top 2 and opposite the side 2.

Next have the class look at the side 2 and top 3. Ask what 2×3 is. Have this answer thumbtacked under the top 3 and opposite the side 2. Then have a child multiply the top 4 by the side 2 and put the answer under the top 4 and opposite the side 2. Have the child continue in this way, multiplying the numbers across the top by the side 2 and thumbtacking the answers until the row is filled. Encourage discussion about the chart as the work progresses.

	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	18	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

Now have the pupils multiply the numerals at the top by the side 3 and put the answers in the proper spaces. Continue in this way until the chart has been filled in with as many multiplication basic facts as the children know.

The heavy line on the chart illustrated shows how far the chart can be filled in when the children have done the work in their text through page 53. Draw a heavy line on the chart as indicated in the picture. Point out to the children that this line shows *how many* facts have been learned and *how few* remain to be learned. This line also indicates the extent to which the basic facts were taught in *Seeing Through Arithmetic 3*. As new facts are learned, the proper numerals may be thumbtacked on the chart.

Whenever any of the children have spare time, you might ask them to paste in the proper place the numerals that have been thumbtacked.

This chart can, of course, also be used to review the division basic facts. When the children want to check division facts, they use the figures in the first column at the left as divisors, the figures in the rows to the right as the numbers that are to be divided, and the figures in the top row as answers.

Activity 25

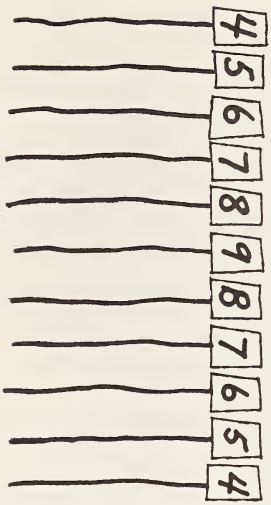
Number football

A "football game" can be improvised very easily in a small space in the classroom. It will create a great deal of interest in practicing the multiplication and division basic facts through the 36 group.

You will need 11 pieces of string, each roughly 4′ long, and 11 pieces of typing paper, six of which are numbered 4 to 9, and five of which are numbered 4 to 8. These numerals should be large enough to be seen easily. You will also need three cardboard ovals, numbered 2, 3, and 4, to represent footballs. (Or you may use boxes, similarly numbered.)

Place the strings about a foot apart and parallel to one another on the floor. They can be fastened down with cellophane tape at each end. (If you prefer, you can draw chalk lines on the floor.) Place the papers under the strings, or tape them over the chalk lines, in ascending numerical order from 4 to 9 and in descending numerical order from 9 to 4. The picture on the next page shows what the football field will look like.

Divide the class into two teams. (There should be both able pupils and slow learners on each side.) Then select two children of similar learning ability, one from each team. (If you wish, several groups may be organized. Two teams of able pupils or two teams of



slow learners could then play against each other.) Give one of the two children a "football" and tell him to start at one end of the field and progress as far as he can. Explain that at each line he must multiply the numeral on his football (if the multiplication basic facts are being practiced) by the numeral on the line and give the answer. If he gives all the answers correctly, he gets 7 points for a touchdown.

Now the pupil from the opposing team carries the ball. He must progress down the field from the opposite end and give all the answers as he goes. If he gives them correctly, he, too, scores 7 for a touchdown. A turn is now given to another pupil from the first team. His football should be one with a numeral different from the one used by the first player.

If a player fails to give a correct answer on his way down the field, his team may send in a substitute. The new player will then try to complete the run to the goal line. If he fails, the ball goes to the opposing team. If this team has already scored with this particular ball, a new player should use a ball with a different numeral.

The game will provide practice for basic facts higher than 36 by using footballs with numerals larger than 4 on them.

This game may be used to practice division basic facts by putting a sequence of dividends all divisible by the same number on the lines and changing the sequence for each football. (Some of the lines will be without numerals.) As the player proceeds down the field, he uses the numeral on his football for the divisor, the numeral on the floor as the number to be divided, and he must give the answer. The game can be adapted to division with remainders by controlling the numerals on the lines.

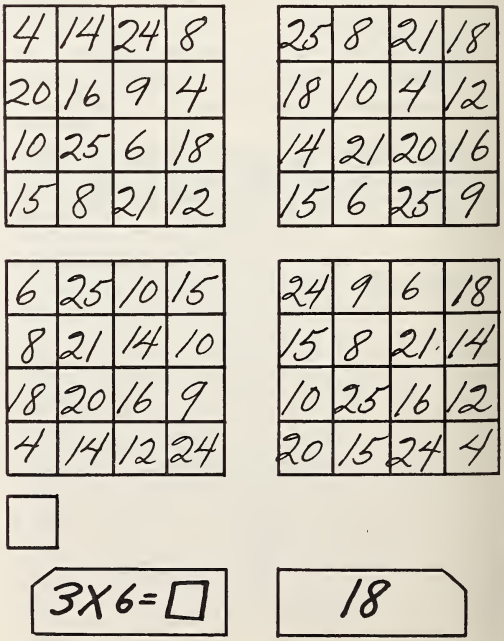
Activity 26

All-in-a-row

Practice on the multiplication and division basic facts can be provided by a game based on the rules described in Activity 6 (page 332).

In advance, prepare master cards, about 5″ x 5″. Rule these cards into four horizontal and four vertical rows. For multiplication, write in each square a numeral that is a product (4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 24, and 25). No two cards should have the same layout, but two of the numerals will occur twice on each card. Be careful to vary the repeated numerals from card to card. For example, if you wish to review the multiplication basic facts through the 25 group, the master cards could look like the four samples in the picture.

Also prepare a set of 32 basic fact cards (2″ x 1″). There should be one card for each basic fact being used. On one side of the card write, without the



answer, a multiplication equation. On the other side, write the answer.

Provide each player with 16 "cover" cards. These are construction-paper squares, slightly smaller than the squares on the master cards (about 1″ x 1″), to use to cover the answers when a basic fact is called.

Any number of pupils may play the game, as long as there is a master card available for each. One child should be selected as the "caller" for each game. The "caller" draws a basic fact card and reads it without the answer. Each player looks to see if he has the answer for this basic fact on his master card. If a player does have the answer, he covers it with one of his cover cards.

The "caller" should put down the basic fact card he has called with the answer side up. Later he will use this pile of basic fact cards to check the winning master card. The "caller" will continue to draw and read basic facts until a child has a winning master card.

The player wins who first gets a vertical row, a horizontal row, a diagonal row, or the four corners filled with cover cards.

More master cards and basic fact cards can be made as larger number groups are studied. Care should be taken, however, that all the players have master cards including answers for the same basic facts. When the cards are being prepared, a notation can be made on the backs showing the range of the facts included.

For division, the game is played in the same way. Division basic fact cards will have to be made for the "caller" to use. The master cards will show the answers to division basic facts which include only the numbers 2 to 9. Each of these numerals will be used twice on each master card. Be careful to vary the arrangement from card to card. When a basic fact whose answer is 2 is called, each child will place a cover card over one of the 2's on his master card. The next time a basic fact whose answer is 2 is called, he will place a cover card over the other 2.

Activity 27

Circling equal groups

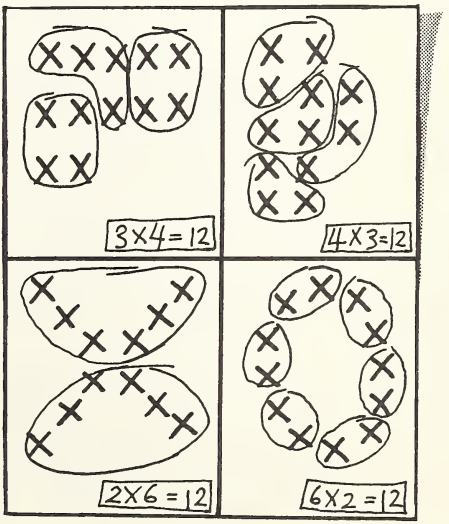
Duplicate sheets of paper containing groups of X's (or simply drawn pictures) for the children to circle into equal groups to illustrate the multiplication and division basic facts. Arrange the groups of X's in a variety of ways for each number group and make more groups of X's than there are basic facts for that number.

For example, there are four basic facts for the 12 group; therefore, you will put five or six or more groups of 12 X's on a page and arrange the X's in each group differently. The object of doing this is to let the child decide for himself how many basic facts the 12 group has. He will circle one group of X's to illustrate each basic fact.

A number group such as 12, which has four basic facts, may require a whole sheet of paper; but you may wish to combine on one page number groups with fewer basic facts. For instance, it would be possible to make at the top of a sheet of paper several groups of X's for 9, which has only one basic fact, and on the bottom half of the sheet other groups of X's for the number 10, which has two facts.

When the children use these sheets, they must first determine the total number of X's in each picture. This will be the number that the X's illustrate. Then they will have to decide how many basic facts this number has. Be sure they understand that for each number there are more groups of X's than they need. Have them write a basic fact equation in each picture, then decide from the equation how many X's they will circle, and how many circles they will make for that picture.

A variation of this activity can be worked out at the chalkboard by children who work in pairs. A slow learner may be paired with an able student. The able student can make X's on the board for a number group. The other pupil can then circle the X's as he is directed by his partner and write the basic fact.



Activity 28

Buy it

When studying money, some children may need more practice in finding ways in which amounts of money can be made up in various combinations of coins.

For this activity, provide some cards identified by letters and have drawn, pasted, or stamped on each one some familiar object, such as a toy or a book. The cards should also show the price of the object.

Let a child select a card and then show on his paper (which he should mark with a letter to match the card chosen) what coins he might use to make up the required sum. Have him draw circles to represent the coins. (These circles for coins may here and for future work be drawn freehand.) On each coin-circle he is to write the number of cents the coin represents (1 for penny, 5 for nickel, 10 for dime, etc.). Tell the child to make as many different combinations of coins as he can for the amount specified on the card.

Activity 29

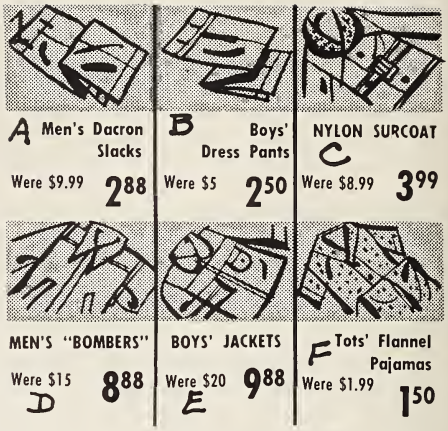
Bargains

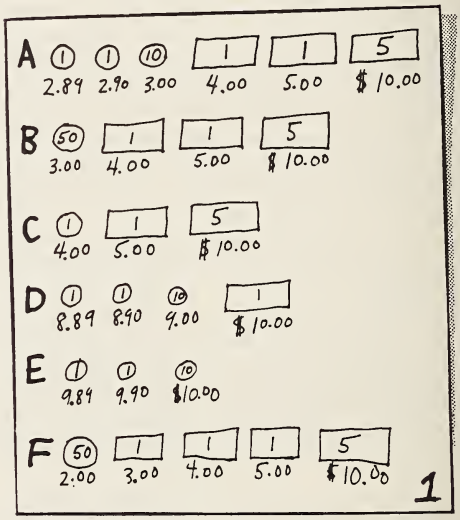
Let pupils look through newspapers to find advertisements featuring a number of articles for sale at bargain prices. The materials for this activity may be kept and used later on for change-making activities and for the subtraction of money. Have the children select and cut out only advertisements showing both the former price of the article offered for sale and the reduced price. When advertisements of this type have been pasted on cards, tell the children to letter each of the articles featured. A sample card might look somewhat like the one shown at the right. Extraneous material in an advertisement can be crossed out to avoid confusion.

For change-making practice, tell the pupils that they are to pretend to buy each article in turn, each time offering the clerk a $10 bill to pay for it. Real or play money can be used to make change. Require the child who is the clerk to count the change correctly as he gives it.

The cards can also be used for written work. Direct the child to write on his paper, opposite the appropriate letter, how the change might have been made by the clerk. He is to do this by drawing circles for the coins and rectangles for the bills, marked with the denominations of the currency represented. (See page 74 of *Book 4*.) Below each coin or bill he is to write, in numerals, the amount the clerk would say as he gave each piece of money. Since he might make up this change in a number of ways, depending on the character of the money he had, the coins and bills the children draw may be quite different in arrangement. Only one way of making up the change for each of the articles in the picture above is shown in the sample paper illustrated above.

The cards can be used for subtraction practice by having each pupil find how much he would save by buying each article at the sale price instead of at the regular price. He should use the letter label of the articles to label his subtraction work.

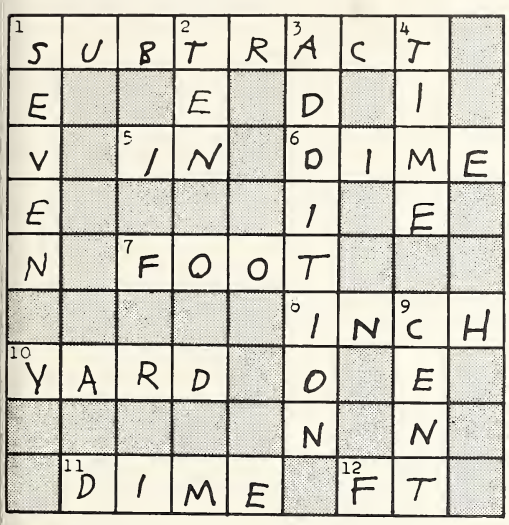




Activity 30

Crossword puzzles

Crossword puzzles can be a means of reviewing arithmetic ideas. Able pupils should enjoy working them and can profit by using them in their spare time. The puzzle form can be put on one side of the card and the key on the other side.



Across

1 The minus sign means to ____.

5 Abbreviation for inch

6 Coin with value of 10¢

7 12 inches equal 1 ____.

8 The unit of measurement that you would use in measuring a crayon

10 Three feet equal one ____.

11 Two nickels equal one ____.

12 Abbreviation for foot

Down

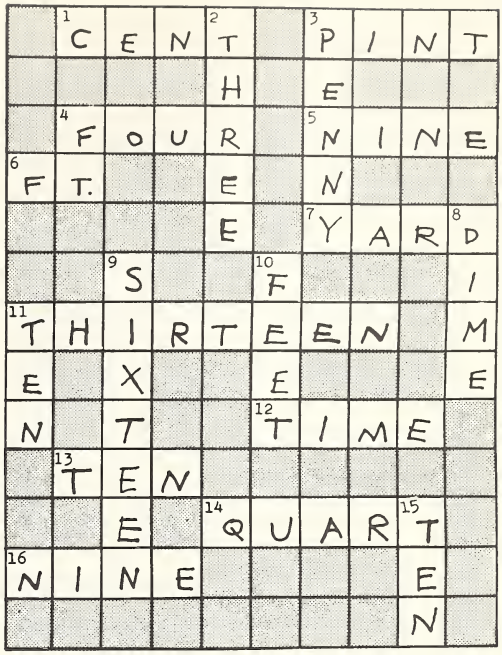
1 Three plus four equals ____.

2 Five times two equals ____.

3 The sign + should suggest ____.

4 Clocks tell ____.

9 The coin of least value is called a ____.



Across

1 Another name for a penny

3 One-half quart equals one ____.

4 Eight divided by 2 equals ____.

5 Three times three equals ____.

6 Abbreviation of the word foot

7 Three feet equal one ____.

11 Add nine and four.

12 A clock tells ____.

13 Two times five equals ____.

14 Two pints equal one ____.

16 Multiply three by three.

Down

2 Nine divided by three equals what?

3 What is one cent sometimes called?

4 Abbreviation for foot

8 Two nickels are equal to one ____.

9 Add nine to seven.

10 One yard equals three ____.

11 Multiply five by two.

15 Add seven to three.

Activity 31

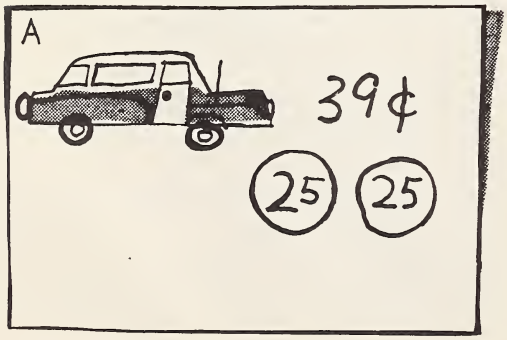
Change-making cards

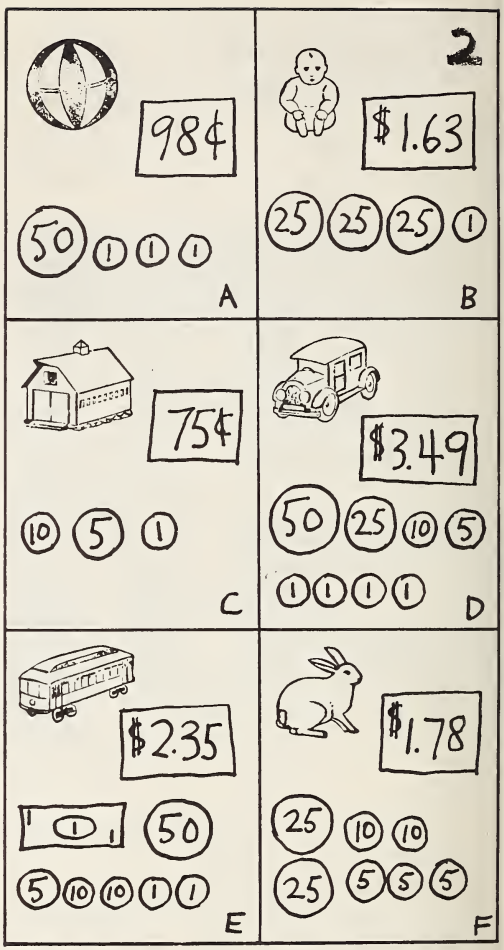
To give practice in making change for amounts less than one dollar, prepare 4″ x 6″ cards as follows: on each, draw or stamp an object that is for sale, mark it with its price tag, and draw coins that might be used in paying for it. The total amount of the coins shown must be *more* than the amount shown on the price tag, since the cards are being prepared for a change-making activity.

If you wish to have the children help in making these cards, discuss with them some of the toys that can be bought for less than one dollar. Select toys that are easy to draw and list them on the board. Let the children decide the price of each toy. Write these prices on the board opposite the listed toys. Then give each child one or two cards or pieces of oaktag, and have him draw one of the toys listed with its price. Tell him to draw one or more circles on a card for the coins that might be used in buying the toy. (Caution him not to put more coins on the card than are necessary.) The child should show what each circle represents by writing a numeral on it (1 for penny, 5 for nickel, 10 for dime, etc.). (See page 74 of *Book 4*.) Each card should be labeled by a letter, which should be used by the child to identify his work for that card.

When the cards have been made, let each child select a card. Have him write on his paper the letter that identifies the card. Then have him show the coins he would use in making change by drawing circles (for coins) and writing in each of them the numeral that indicates the value of the coin.

Cards like the one illustrated below may be used from time to time as supplementary work. Let the children choose cards they have not used previously. Let children compare their work for the same cards.





Activity 32

Money cards

Money cards showing a number of articles, their prices, and coins can provide a number of independent activities, including practice in solving problems of the "how much more is needed" type and "how much there was in the beginning" type.

Have the children stamp or draw pictures of toys on cards. Several pictures can be drawn on one card. Beside each toy put a price tag. Under each picture draw coins. Be sure the coins amount to less than the price of the toy. (See illustration above.) Each card made should have an identifying number on it, and

each small picture should have an identifying letter. Children should use these in labeling their work.

The child is to take one card, write the number of the card at the top of his paper and the letter of each picture in a column on his paper. If you want him to practice finding the "how much more is needed" type of problem, tell him he is to think of the price tag as the price of the toy, and of the coins as the amount of money he has. Tell him to find how much more money he needs to buy the toy. He should make the equation, putting a screen or square in the proper place. Then he must put the work in computational form, do the computation, and rewrite the equation with the answer in the proper place, or put the answer inside the square in his first equation.

For the "how much there was in the beginning" type of problem, the child is to think of the price tag on the toy as showing what he paid for it and the coins as the money he had left. He is then to make the equation to find how much money he had to begin with (▒−$.98=$.53 for A).

Activity 33

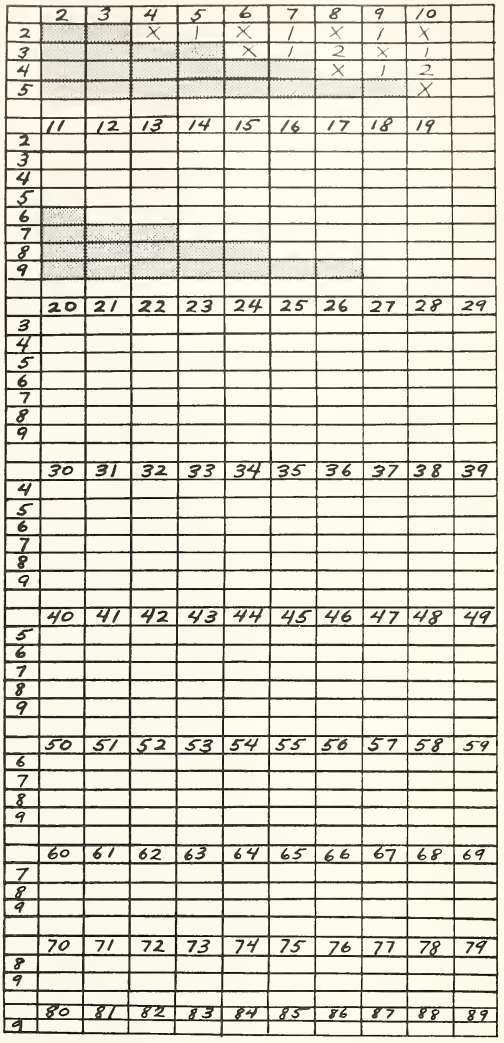
With or without a remainder?

To summarize the division basic facts through the 81 group, a chart may be made. This chart can be made on graph paper or ruled paper and should be prepared in advance. (See the illustration at the right.) The numerals in the horizontal rows are dividends, and those in the vertical column at the left are divisors.

There are nine sections in this chart, each of which has numerals at the left and at the top. The child is to write an X in a space if the number in the top row can be divided by the number opposite (in the column at the left side) without a remainder. If there is a remainder, the child is to write the remainder in the space instead of an X. The illustration shows how the first section should look after it has been filled in.

The shaded parts of the chart should be disregarded. Notice, also, that the numerals in the left-hand column differ in the sections. These omissions have been made so that the children will not get involved with answers of 1 or 1 and a remainder.

Copies of this chart may be made for all of the able pupils, or, if one chart is made, perhaps the children can make their own. Also, if you wish, one or more charts may be made and cut apart by sections. The sections can then be distributed among the children. When all the sections have been filled in, they may be pasted together as complete charts.



Activity 34

Remainders

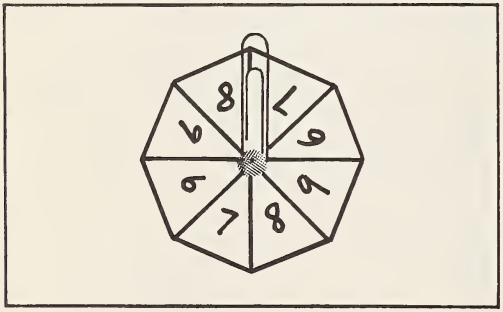
This game, which requires a specially prepared board and a spinner, gives children practice in dividing numbers that involve remainders. Only two children can play at a time. The players can be rotated by having the winner of each game challenge a new child.

The numerals written on the spinner determine the numbers to be put on the playing board. Here are four sets of corresponding numbers for the spinner and the board:

Spinner	*Board*
6-7-8-9	18 to 59
3-4-5-6	12 to 29
4-5-6-7	14 to 39
7-8-9	18 to 69

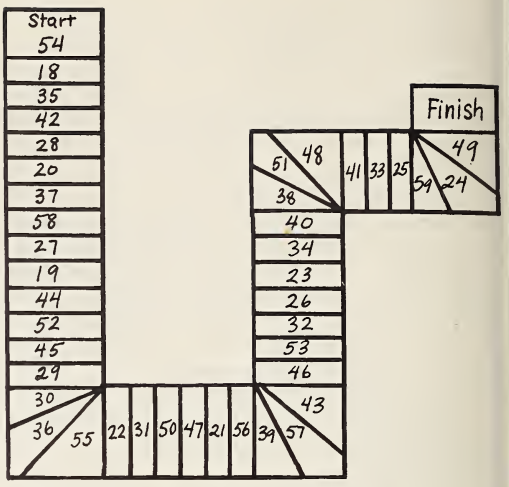
The spinner can be drawn on a piece of oaktag. Be careful to leave enough space around the spinner so that a child can hold the card without touching the spinner with his fingers. For the first three sets of spinner numerals given above, the spinner should be eight-sided. The last set of numerals will require only a six-sided spinner. If the spinners are made in this way, each numeral can be used twice on it. If an eight-sided spinner is used for 7, 8, and 9, use two of the numerals three times.

In drawing the spinner, make strong pencil or crayon lines to delineate each section or wedge. Fasten a paper clip to the center of the spinner by putting the double flanges of a brass brad through the paper clip and then through the spinner. Fold back the two ends of the brad on the under side of the card. (It is important to fasten the brad loosely, so that the clip can spin easily.) The illustration below shows a spinner with the first set of spinner numerals listed above. Note that the numerals 6 to 9 have been used twice.



The playing board to accompany this spinner should look like the one above at the right. The path from "start" to "finish" could, of course, take any shape. There should be enough space on each side of the numerals so that markers will not cover them.

Each child should be given a distinctive marker. To start the game, each child should place his marker beside the numeral 54. One child spins. If the clip stops on a number that divides 54 (i.e., without a remainder), he must stay there. If it falls on a number which will leave a remainder when 54 is divided by it, he can move his marker forward as many spaces as the number in the remainder indicates. For example, if the spinner stops at 8, the answer to "54÷8" is "6 and a remainder of 6." The child can advance his marker 6 spaces (to the number 37). When he takes his next turn, the number he spins is divided into 37. The first one to reach "Finish" wins the game.



Activity 35

"Make up a problem" game

Have children work in groups and take turns at being "It" as described below. Let one child do the timing and experiment with lengths of time of 1 minute to 3 minutes to determine how much time should be allowed. (It will be helpful if you can provide this group with a three-minute egg timer, a stop watch, or a watch with a second hand.) The child who is "It" will write on the board an equation with a screen or square for the missing number. Then he will point to a child in the group and ask him to make up a problem to fit the equation. If the child can think of a problem and give the answer before the time is up, he becomes "It." If he cannot think of a problem, the child who is "It" asks another child to make up a problem.

All the children in this group should verify the answers. Make sure they understand that the numbers they use must be within the range of the processes and numbers studied thus far. The child who is "It" the most times is the winner.

Activity 36

Try for the number

Cut twelve 3″ x 5″ white cards in half to make three sets of cards. Number the cards in each set from 2 to 9. Cut in half twelve pink (any color except white) 3″ x 5″ cards to make three sets of cards. Number the cards in each set with the numerals 200, 300, 400, 500, 600, 700, 800, and 900. (If you want to use this game for slow learners, number these cards with the decade numbers from 20 to 90 instead of the "hundreds" numbers.) Four or fewer children may play this game.

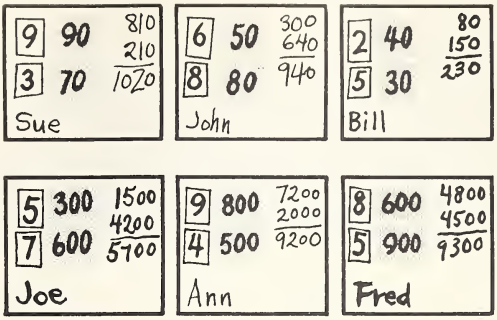
The three sets of white cards should be well shuffled. Also shuffle the three sets of pink cards. Place the pile of white cards face down on the table. Also place the pile of pink cards face down beside the pile of white cards. Each player should draw 2 white cards and 2 pink cards to begin the game.

The object of the game is to see who can manipulate his numbers to come nearest to a game score of 10,000. A player does this by multiplying the numeral on one of his pink cards by the numeral on one of his white cards, then multiplying the numeral on his other pink card by the numeral on his remaining white card and adding the two products together. He should do all of the figuring on paper so that it can be verified. It is unlikely that a child will get a score of exactly 10,000 the first time. If a player has a score that is no more than 1000 points over or under 10,000, he can lay down his cards. If other players also have scores within 1000 points of 10,000, they lay down their cards, too. Then the scores are compared. The player whose score is closest to 10,000 wins the game.

If no one is able to lay his cards down, the scores of that hand are not counted, but the game continues with the same hand except that now the players may improve their hands by drawing one card and discarding one. A player may draw either a white card or a pink card, but he must discard a card of the same color. Discarded cards are placed at the bottom of their respective packs.

If the game is played with decade numbers instead of "hundreds" numbers on the pink cards, the method of play is the same except that, since the pink cards contain smaller numerals, the total aimed for is 1000 instead of 10,000. To lay cards down, a player must have a score that is no more than 100 points over or under 1000.

Sample hands for both the able students and the slow learners, together with the computation kept by the players, are shown at the top of the next column.



In the first set of hands above, both Sue and John think themselves winners because they have scores within 100 points of 1000. Sue proves to be the winner because her score is closer to 1000.

In the next set, Fred is the winner because he is closer than Ann to 10,000.

This game may be adapted for use with multiplication of any two-figure and three-figure numerals. If mental calculating is to be required, use such numerals as 21, 72, 309, 405, and 610.

Activity 37

Fraction maze

This is a game that provides experience in arranging fractions in order of size. By changing the fraction numerals inserted in the maze, the game can easily be adapted for slow or able pupils.

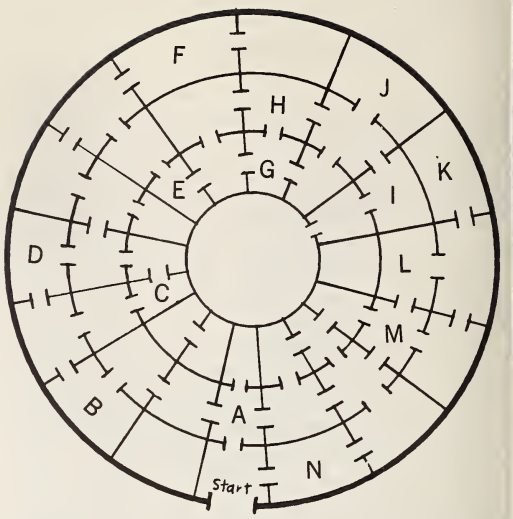
You will need to duplicate a supply of the circular maze. A sample maze is shown on the next page, first with the reference letters on it and then with the fractions from Set 2 in it.

In the spaces labeled by letters, you insert the corresponding fractions from one of the sets that follow (or from a set of your own making). Of course, the letters will not appear on the maze. They are shown on the sample for reference only. In each set, letters A, B, D, E, G, and I, which are listed first, lead to the center. The other letters are on a false trail. Many sets of numerals, including proper fractions, improper fractions, and mixed numbers, can be used. Variety can be given to the game by including two kinds of numerals in one maze.

Abler children may enjoy planning mazes of their own. They can make their mazes inside circles, drawn by outlining coffee cans, or inside squares. Let children check one another's mazes to make sure that they are not defective.

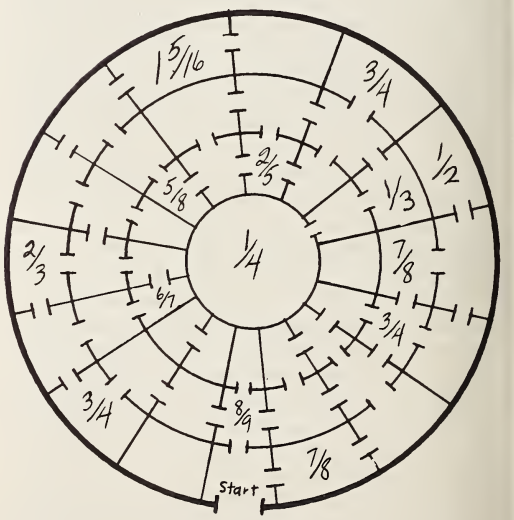
For able pupils

Set 1		Set 2	
A $5\frac{3}{4}$	C $5\frac{1}{3}$	A $\frac{8}{9}$	C $\frac{6}{7}$
B $5\frac{1}{2}$	F $4\frac{1}{2}$	B $\frac{3}{4}$	F $\frac{15}{16}$
D $4\frac{1}{3}$	H $3\frac{1}{8}$	D $\frac{2}{3}$	H $\frac{1}{2}$
E $4\frac{1}{5}$	J $3\frac{1}{2}$	E $\frac{5}{8}$	J $\frac{3}{4}$
G $3\frac{7}{8}$	K 2	G $\frac{2}{5}$	K $\frac{1}{2}$
I $2\frac{1}{6}$	L $3\frac{1}{3}$	I $\frac{1}{3}$	L $\frac{7}{8}$
Center 2	M $3\frac{2}{3}$	Center $\frac{1}{4}$	M $\frac{3}{4}$
	N $4\frac{6}{8}$		N $\frac{7}{8}$



For slow learners

Set 3		Set 4	
A $\frac{11}{12}$	C $\frac{7}{12}$	A $\frac{1}{2}$	C $\frac{1}{14}$
B $\frac{9}{12}$	F $\frac{5}{12}$	B $\frac{1}{4}$	F $\frac{1}{10}$
D $\frac{6}{12}$	H $\frac{4}{12}$	D $\frac{1}{9}$	H $\frac{1}{3}$
E $\frac{4}{12}$	J $\frac{8}{12}$	E $\frac{1}{11}$	J $\frac{1}{9}$
G $\frac{3}{12}$	K $\frac{10}{12}$	G $\frac{1}{13}$	K $\frac{1}{10}$
I $\frac{2}{12}$	L $\frac{5}{12}$	I $\frac{1}{15}$	L $\frac{1}{5}$
Center $\frac{1}{12}$	M $\frac{7}{12}$	Center $\frac{1}{16}$	M $\frac{1}{8}$
	N $\frac{10}{12}$		N $\frac{1}{10}$



In playing the game, the child is to begin drawing a line in the space labeled "start." Instruct him to proceed, drawing the line through whichever "open door" gets him to a number smaller (or larger, if you arrange the numerals in ascending order) than the one he has just passed by. From there, he is to continue drawing the line, going to the next smaller (or larger) fraction until he reaches the center. If the child needs help in determining the relative sizes of the fractions, let him use the flannel board or his own drawings.

Reference materials

This section of the *Teaching Guide* provides you with charts and tables that will enable you to understand better both the entire program and the materials for this grade.

Bibliography

A list of books and articles that should add interest to and help in the teaching of arithmetic

Chart of problem types

An analysis of the types of verbal problems that the child learns to solve

Time schedule

The authors' estimate of the rate of progress you may expect to make during the year

Grade placement chart

A graphic means of discovering the grade placement of the important topics in arithmetic for Grades 1 to 6 in this program

Word list

A complete alphabetical list of all words used in the pupil's book

Mathematical content

A detailed topical list of the mathematical content of the book

Index

Entries are for the teaching aspects of arithmetic

Reference materials

Bibliography

Arithmetic method

This list includes the methods books that have been published during the last ten years. No attempt has been made by the authors of *Seeing Through Arithmetic 4* to evaluate these books.

Brueckner, Leo J., and Grossnickle, F. E. *Making Arithmetic Meaningful.* Philadelphia: John C. Winston Co., 1953.

Buckingham, B. R. *Elementary Arithmetic: Its Meaning and Practice.* Boston: Ginn and Company, 1947.

Clark, John R., and Eads, Laura K. *Guiding Arithmetic Learning.* Yonkers, New York: World Book Company, 1954.

Hickerson, J. Allen. *Guiding Children's Arithmetic Experiences.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1952.

Morton, Robert L. *Teaching Children Arithmetic: Primary, Intermediate, Upper Grades.* New York: Silver Burdett Company, 1953.

Risden, Gladys. *How Big? How Many? Arithmetic for Home and School.* Boston: Christopher Publishing House, 1951.

Rosenquist, Lucy Lynde. *Young Children Learn to Use Arithmetic.* Boston: Ginn and Company, 1949.

Spencer, Peter Lincoln, and Brydegaard, Marguerite. *Building Mathematical Concepts in the Elementary School.* New York: Henry Holt and Company, 1952.

Spitzer, Herbert F. *The Teaching of Arithmetic.* 2d ed. Boston: Houghton Mifflin Company, 1954.

Stern, Catherine. *Children Discover Arithmetic: An Introduction to Structural Arithmetic.* New York: Harper and Brothers, Publishers, 1949.

Stokes, C. Newton. *Teaching the Meanings of Arithmetic.* New York: Appleton-Century-Crofts, Inc., 1951.

Wheat, Harry G. *How to Teach Arithmetic.* Evanston, Illinois: Row, Peterson and Co., 1951.

Williams, Catherine. *Teaching Arithmetic in the Elementary School.* New York: Hinds, Hayden, and Eldredge, 1946.

Wilson, Guy M., and Others. *Teaching the New Arithmetic.* 2d ed. New York: McGraw-Hill Book Company, 1951.

Modern learning theory

Many of the changes that are being made in the methods of teaching arithmetic arise from the application of modern principles of teaching to arithmetic. These principles are discussed in the following books.

Cole, Lawrence E., and Bruce, William F. *Educational Psychology.* Yonkers, New York: World Book Co., 1950. Ch. 11-14.

Commins, W. D., and Fagin, Barry. *Principles of Educational Psychology.* 2d ed. New York: The Ronald Press, 1954. Ch. 12-16.

Douglas, O. B., and Holland, B. F. *Fundamentals of Educational Psychology.* New York: Macmillan Company, 1938. Ch. XIV.

Gates, Arthur I., and Others. *Educational Psychology.* 3d ed. New York: Macmillan Company, 1948. Ch. IX-XIV.

Werner, Heinz. *Comparative Psychology of Mental Development.* New York: Harper and Brothers, Publishers, 1940. Ch. IX.

Wertheimer, Max. *Productive Thinking.* New York: Harper and Brothers, Publishers, 1945. Ch. I.

Woodruff, A. D. *The Psychology of Teaching.* 3d ed. New York: Longmans, Green and Company, 1951 Ch. XIV.

Selected research studies

Anderson, G. Lester. "Quantitative Thinking As Developed Under Connectionist and Field Theories of Learning," *Learning Theory in School Situations,* pp. 40-73. University of Minnesota Studies in Education, No. 2. Minneapolis: University of Minnesota Press, 1949.

Brownell, William A. "Arithmetical Readiness As a Practical Classroom Concept," *Elementary School Journal,* LII (September, 1951), 15-22.

Brownell, W. A., and Carper, Doris V. *Learning the Multiplication Combinations.* Duke University Research Studies in Education, No. 7. Durham: Duke University Press, 1943.

Brownell, W. A., and Moser, Harold E. *Meaningful vs. Mechanical Learning: A Study in Grade III Subtraction.* Duke University Research Studies in Education, No. 8. Durham: Duke University Press, 1949.

Brownell, W. A., and Others. *Arithmetic in Grades I and II, A Critical Summary of New and Previously Reported Research.* Duke University Research Studies in Education, No. 6. Durham: Duke University Press, 1941.

Brownell, W. A., and Others. *Learning As Reorganization, An Experimental Study in Third Grade Arithmetic.* Duke University Research Studies in Education, No. 3. Durham: Duke University Press, 1939.

Buswell, Guy T. (editor). *Improving the Program in Arithmetic.* Proceedings of the Conference on Arithmetic, 1946. Chicago: The University of Chicago Press, 1947.

Dutton, Wilbur H. "Attitudes of Prospective Teachers Toward Arithmetic," *Elementary School Journal,* LII (October, 1951), 84-90.

Ilg, Frances, and Ames, Louise B. "Developmental Trends in Arithmetic," *Pedagogical Seminary and Journal of Genetic Psychology,* LXXIX (September, 1951).

Koenker, Robert H. "Arithmetic Readiness at the Kindergarten Level," *Journal of Educational Research,* XLII (November, 1948), 218-223.

McLaughlin, Katherine L. *A Study of Number Ability in Children of Ages Three to Six.* Ph.D. Dissertation, Chicago: The University of Chicago Press (private edition), 1935.

Martin, William E. "Quantitative Expression in Young Children," *Genetic Psychology Monographs,* XLIV (November, 1951), 147-219.

Osburn, W. J. "Division by Dichotomy As Applied to the Estimation of Quotient Figures," *Elementary School Journal,* L (February, 1950), 326-330.

Passehl, George. "Teaching Arithmetic Through Activity Units," *Peabody Journal of Education,* XXVII (November, 1949), 148-152.

Plank, Emma N. "Observations on Attitudes of Young Children Toward Mathematics," *The Mathematics Teacher,* XLIII (October, 1950), 252-263.

Swenson, Esther J. "Organization and Generalization As Factors in Learning, Transfer, and Retroactive Inhibition," *Learning Theory in School Situations,* pp. 9-39. University of Minnesota Studies in Education, No. 2. Minneapolis: University of Minnesota Press, 1949.

Thiele, C. L. *The Contribution of Generalization to the Learning of the Addition Facts.* Contributions to Education, No. 763. New York: Bureau of Publications, *Teachers College Record,* Columbia, 1938.

Van Engen, Henry, and Gibb, E. Glenadine. *Some General Mental Functions Associated with Division.* Educational Services Studies, No. 2. Cedar Falls, Iowa: Iowa State Teachers College, 1956.

Selected articles, monographs, and yearbooks

Amsden, Constance E. "Seeing the Meaning of Plus and Minus," *Educational Screen,* XXX (March, 1951), 100-102.

Brownell, William A. "The Revolution in Arithmetic," *The Arithmetic Teacher,* I (April, 1954), 1-5.

Burch, Robert L. "Skills Instruction in Arithmetic," *National Elementary Principal,* XXIX (Dec., 1949).

Buswell, Guy T. (editor). *Arithmetic 1947.* Supplementary Educational Monographs, No. 63. Chicago: The University of Chicago Press (Oct., 1947).

Buswell, Guy T. (editor). *Arithmetic 1948.* Supplementary Educational Monographs, No. 66. Chicago: The University of Chicago Press (Oct., 1948).

Buswell, Guy T., and Hartung, Maurice L. (editors). *Arithmetic 1949.* Supplementary Educational Monographs, No. 70. Chicago: The University of Chicago Press (November, 1949).

Clark, John R. "Issues in Teaching Arithmetic," *Teachers College Record,* LII (Jan., 1951), 205-212.

Deans, Edwina. "The Contribution of Grouping to Number Development," *Childhood Education,* XVII (March, 1941), 307-310.

Gibb, E. Glenadine. "Take-Away Is Not Enough!" *The Arithmetic Teacher,* I (April, 1954), 7-10.

Grossnickle, Foster E. "How to Find the Position of the Decimal Point in the Quotient," *Elementary School Journal,* LII (April, 1952), 452-457.

Hartung, Maurice L. "Forward Look at Evaluation," *The Mathematics Teacher,* VLII (Jan., 1949), 29-33.

Hartung, Maurice L. "Major Instructional Problems in Arithmetic in the Middle Grades," *Elementary School Journal,* L (October, 1949), 86-91.

Hartung, Maurice L. "The Order of Operations in Elementary Mathematics," *School Science and Mathematics,* XLVI (November, 1946), 752-754.

Johnson, J. T. "The Use of a Ruler in Teaching Place Value in Numbers," *The Mathematics Teacher,* XLV (April, 1952), 264-266.

Judd, Charles Hubbard. *Psychological Analysis of the Fundamentals of Arithmetic.* Supplementary Educational Monographs, No. 32. Chicago: The University of Chicago Press, 1927. Ch. V, VI.

Moser, Harold E. "Can We Teach Pupils to Distinguish the Measurement and Partition Ideas in Division?" *The Mathematics Teacher*, XLV (February, 1952), 94-97+.

Moser, Harold E. "Two Procedures for Estimating Quotient Figures When Dividing by Two-Place Numbers," *Elementary School Journal,* XLIX (May, 1949), 516-522.

National Council of Teachers of Mathematics Tenth Yearbook: *The Teaching of Arithmetic*. Washington, D.C.: National Council, 1935.

National Council of Teachers of Mathematics Sixteenth Yearbook: *Arithmetic in General Education*. Washington, D.C.: National Council of Teachers of Mathematics, 1941. See especially Chapter XI: "Recent Trends in Learning Theory: Their Application to the Psychology of Arithmetic," by T. R. McConnell.

National Council of Teachers of Mathematics Twenty-First Yearbook: *The Learning of Mathematics*. Washington, D.C.: National Council of Teachers of Mathematics, 1953. See especially Chapter II: "Motivation for Education in Mathematics," by Maurice L. Hartung.

National Society for the Study of Education Forty-First Yearbook, Part II: *The Psychology of Learning*. Distributed by The University of Chicago Press, 1942. See especially Chapter I: "Conditioning: A Theory of Learning in Terms of Stimulus, Response, and Association," by E. R. Guthrie; Chapter VI: "Field Theory and Learning," by Kurt Lewin; and Chapter VII: "Reconciliation of Learning Theories," by T. R. McConnell.

National Society for the Study of Education Forty-Fifth Yearbook, Part I: *The Measurement of Understanding*. Distributed by The University of Chicago Press, 1946.

National Society for the Study of Education Forty-Ninth Yearbook, Part I: *Learning and Instruction*. Distributed by The University of Chicago Press, 1950. See especially Chapter I: "The General Nature of Learning," by G. Lester Anderson and Arthur I. Gates; Chapter IV: "How Children Learn Information, Concepts, and Generalizations," by William A. Brownell and Gordon Henrickson; Chapter X: "Applications of Learning Principles to the Improvement of Teaching in the Early Elementary Grades," by Esther J. Swenson; and Chapter XI: "Implications for Improving Instruction in the Upper Elementary Grades," by G. Max Wingo.

National Society for the Study of Education Fiftieth Yearbook, Part II: *The Teaching of Arithmetic*. Distributed by The University of Chicago Press, 1951.

Roudebush, Elizabeth J. "An Arithmetic Bulletin for Parents," *The Mathematics Teacher,* XLIV (May, 1951), 289-292.

Smith, Rolland R. "Meaningful Division," *The Mathematics Teacher,* XLIII (January, 1950), 12-18.

Trimble, H. C. "Fractions Are Ratios Too," *Elementary School Journal*, XLIX (Jan., 1949), 285-291.

Van Engen, Henry. "An Analysis of Meaning in Arithmetic," *Elementary School Journal,* XLIX (February-March, 1949), 321-329, 395-400.

Van Engen, Henry. "Some More Thoughts on Placing the Decimal Points in Quotients," *The Mathematics Teacher*, XXXVIII (Oct., 1945), 243-245.

Van Engen, Henry. "Teaching the Mathematical Skills in the Elementary School," *Progressive Education,* XXIX (October, 1951), 17-20.

Van Engen, Henry. "Which Way Arithmetic?" *The Arithmetic Teacher*, II (Dec., 1955), 131-140.

Weaver, J. Fred. "A Crucial Aspect of Meaningful Arithmetic Instruction," *The Mathematics Teacher,* XLIII (March, 1950), 112-117.

Weaver, J. Fred. "Misconceptions about Rationalization in Arithmetic," *The Mathematics Teacher,* XLIV (October, 1951), 377-381.

Weaver, J. Fred. "Some Areas of Misunderstanding about Meaning in Arithmetic," *Elementary School Journal,* LI (September, 1950), 35-41.

Williams, Catharine M. "Arithmetic Learning in an Experience Curriculum," *Educational Research Bulletin,* XXVIII (September, 1949), 154-162+.

Useful bibliographies

Burch, R. L., and Moser, H. E. "Teaching of Mathematics in Grades I Through VIII," *Review of Educational Research,* XXI (October, 1951), 290-304.

Johnson, Harry C. "Problem-Solving in Arithmetic: A Review of the Literature," *Elementary School Journal,* XLIV (March-April, 1944), 396-403, 476-482.

National Council of Teachers of Mathematics Sixteenth Yearbook, Ch. XIV and XV.

Van Engen, Henry. "A Summary of Research and Investigations and Their Implications for the Organization and Learning of Arithmetic," *The Mathematics Teacher*, XLI (Oct., 1948), 260-265.

Problem types

additive and subtractive situations

type na.	problem description	sample problem	equation	campu-tatian	situation-process description	grade
AS-1	Finding the resulting total when the ariginal number and the number added are knawn	John had 9 apples. Tam gave him 3 apples. How many apples did Jahn have then?	$9 + 3 = n$	$9 + 3$	additive-additian	3
AS-2	Finding how many were added ar haw many mare are needed when the original number and the resulting tatal ar desired tatal are known	John had 9 apples. After Tam had given him some more apples, he had 12 apples. How many apples did Tom give him?	$9 + n = 12$	$12 - 9$	additive-subtractian	3
AS-3	Finding how many there were ta begin with when the number added and the resulting total are knawn	Jahn had some apples. Tom gave him 3 apples. Then he had 12 apples. How many apples did John have to begin with?	$n + 3 = 12$	$12 - 3$	additive-subtraction	3
AS-4	Finding the number left when the original number and the number gone are known	John had 12 apples. He lost 3 of them. How many apples did he have then?	$12 - 3 = n$	$12 - 3$	subtractive-subtraction	3
AS-5	Finding the number gone when the original number and the number left are known	John had 12 apples. Then he lost some. He had 9 apples left. How many apples did he lose?	$12 - n = 9$	$12 - 9$	subtractive-subtraction	4
AS-6	Finding the original number when the number gone and the number left are known	John had some apples. He lost 3 of them. Then he had 9 apples left. How many apples did he have to begin with?	$n - 3 = 9$	$9 + 3$	subtractive-addition	4
	rate situations					
R-1	Finding the total number when the number in each group and the number of equal groups are known	John had 4 boxes of 3 apples each. How many apples did he have?	$4 \times 3 = n$ $\frac{3}{1} = \frac{n}{4}$	4×3	multiplicative-multiplication rate-multiplication	3 5
R-2	Finding the number in each of the equal groups when the resulting total number and the number of groups are known	John put 4 equal groups of apples into a box. Then he saw that he had 12 apples in the box. How many apples were in each group that he put into the box?	$4 \times n = 12$ $\frac{n}{1} = \frac{12}{4}$	$12 \div 4$	multiplicative-division rate-division	5 5
R-3	Finding the number of equal groups when the resulting total number and the number in each of the equal groups are known	John put several groups of 3 apples each into a box. Then he saw that he had 12 apples in the box. How many groups of apples did he put into the box?	$n \times 3 = 12$ $\frac{3}{1} = \frac{12}{n}$	$12 \div 3$	multiplicative-division rate-division	5 5
R-4	Finding the number of equal groups when the original total and the number in each of the equal groups are known	John had 12 apples. He put a group of 3 apples into each of several boxes. How many boxes did he use?	$12 \div 3 = n$ $\frac{3}{1} = \frac{12}{n}$	$12 \div 3$	quotitive-division rate-division	3 5
R-5	Finding the number in each of the equal groups when the original total and the number of equal groups are known	John had 12 apples. He put equal groups of these apples into each of 4 boxes. How many apples did he put into each box?	$12 \div n = 4$ $\frac{n}{1} = \frac{12}{4}$	$12 \div 4$	partitive-division rate-division	3 5
R-6	Finding the original number when the number in each of the equal graups and the number of equal groups are knawn	John had same apples to put into 4 baxes. He put 3 apples into each box. How many apples did he have to put into the baxes?	$n \div 3 = 4$ $\frac{3}{1} = \frac{n}{4}$	4×3	divisive-multiplication rate-multiplicatian	5 5

comparison situations

ype o.	problem description	sample problem	equation	compu-tation	situatian-process description	grade
-1	Finding how {many more / much more} or how {many fewer / much less} one quantity is than another	John has 12 apples and 9 oranges. How many {more apples / fewer oranges} than {oranges / opples} has he?	$12 - 9 = n$	$12 - 9$	comparisan-subtractian	3
-2	Finding the smaller quantity when the larger quantity and the excess of the larger quantity or the deficiency of the smaller quantity are known	John hos 12 apples. He has 3 {more apples than oranges. / fewer oranges than opples.} How many oranges has he?	$12 - n = 3$	$12 - 3$	comporison-subtraction	6
-3	Finding the larger quantity when the smaller quantity and the deficiency of the smaller quantity or the excess af the larger quantity ore known	John hos 9 apples. He has 3 {more oranges than apples. / fewer apples than oranges.} How many oranges has he?	$n - 9 = 3$	$9 + 3$	comparison-oddition	6
-4	Finding the ratio of ane quantity to another (situations involving "times as many as," "fraction as many as")	John has 12 apples and 4 oranges. He has how many times os many apples as oranges? He has what fraction as mony oranges as apples?	$\frac{n}{1} = \frac{12}{4}$ $\left(\frac{1}{n} = \frac{12}{4}\right)$	$12 \div 4$ $(4 \div 12)$	comparison-division	5 6
-5	Finding a quantity when the other quantity and the ratio ("number times as many as" or "fraction as many as") of the first quantity to it are known	John has 12 apples. He has {3 times as many / ⅓ as many} apples as oranges. How many oranges has he?	$\frac{3}{1} = \frac{12}{n}$ $\left(\frac{⅓}{1} = \frac{12}{n}\right)$	$12 \div 3$ $(12 \div ⅓)$	comparison-division	5 6
-6	Finding a quantity when the other quantity and its ratio ("number times as many as" or "fraction as many as") to the first quantity are known	John has 12 oranges. He hos {3 times as many / ⅓ as mony} apples as oranges. How many apples has he?	$\frac{3}{1} = \frac{n}{12}$ $\left(\frac{⅓}{1} = \frac{n}{12}\right)$	3×12 $(⅓ \times 12)$	comparison-multiplication	5 6

Time schedule

The authors do not believe it possible to provide a rigid schedule for teachers to follow in using *Seeing Through Arithmetic 4*. Differences in the backgrounds and abilities of children make a uniform schedule impractical. Nevertheless, many teachers and schools feel a need for some kind of schedule that will serve as a general guide in covering the year's work. The schedule at the right, given in six-week periods, is based upon the authors' judgment and experience with the materials and upon the experience of teachers now using *Book 4*. No attempt should be made to force a class to maintain the pace indicated or to retard a class to that pace.

periad	pages of book 4	content
1	3-67	reteaching of addition and subtraction; basic facts thraugh 36 graup
2	68-125	maney; multiplicatian and division basic facts through 81 group
3	126-156	number system through millions; multiplicatian by 1-figure multiplier
4	157-192	multiplication by 2-figure multiplier; divisian by 1-figure divisar
5	193-222	division by 2-figure divisor; fractions
6	223-251	measures; averages; scale drawing; review

Grade placement of topics

Seeing through arithmetic

Scott, Foresman

topic	grade 1	grade 2	grade 3
groups and number systems	recognizing, combining, separating, and rearranging through 10	recognizing, combining, separating, and rearranging through 18	recognition through 36
decimal system of enumeration	through 99; place value	through 999; place value	through 9999; place value; preparation for carrying and borrowin
basic facts		through sums and minuends of 10; informally through products and dividends of 10	through sums and minuends o through products and dividends of 36
money	coins through dime; related values; counting	coins through quarter; related values; counting	equivalents of $1; writing; making change; addition and subtraction
measures	idea of standard unit; development of judgment and physical competence	idea of standard unit; concept of inch, foot, pint, quart; development of judgment	equivalents; dozen; calendar; time; weight; reduction
processing addition and subtraction of whole numbers			3-figure numbers; carrying and borrowing
processing multiplication of whole numbers			
processing division of whole numbers			
meaning of fractions		judgment in selecting halves and fourths	unit and non-unit through eig reading and writing
processing addition and subtraction of fractions			
processing multiplication of fractions			
processing division of fractions			
ratio (see per cent)			preparation for reduction
graphs and scale drawing			
geometry			identification of circle, square, triangle
decimal fraction numerals			
per cent			
problem solving (see chart on pages 358-359)		pictorial representations; development of visualizations; introduction of action ideas	types AS-1, AS-2, AS-3, AS-4, R-1, R-4, R-5, C-1
meaning of the processes		associating combining and separating actions with problems	order of addends and factor inverse nature of processes
topic	grade 1	grade 2	grade 3

grade 4	grade 5	grade 6	topic
		number line for system of integers and for system of fractions	groups and number systems
through 999,999,999; place value	reading and understanding decimal numerals through hundredths	development of decimal notation as a system	decimal system of enumeration
through products and dividends of 81	used in processes	extension to decimal fraction numerals (as a system)	basic facts
multiplication and division			money
scale; weight; iquid (fl. oz.); dry; mile; abbreviations	square measures; acre;	cubic measures; meter; gram; liter; kilogram; kiloliter	measures
retaught; extended to larger numbers	extended to larger numbers	maintained; associative law for addition	processing addition and subtraction of whole numbers
1-figure and 2-figure multiplier; carrying	extended to larger numbers	maintained; associative law; distributive law	processing multiplication of whole numbers
figure and 2-figure divisors re divisors optional); remainders	2-figure divisors; remainders	maintained; distributive law	processing division of whole numbers
uivalent; improper fraction nerals and mixed numerals; use in measurement	reduction; comparing	maintained	meaning of fractions
	proper fraction numerals and mixed numerals	maintained	processing addition and subtraction of fractions
		proper fraction numerals and mixed numerals	processing multiplication of fractions
		proper fraction numerals and mixed numerals	processing division of fractions
	using ratios to express rate and comparison; reduction	more complex applications of rate and comparison; use of the ratio test	ratio (see per cent)
meaning of linear scale on map	reading scales and scale drawing; interpreting bar graphs and pictographs	making graphs of sets of ordered pairs	graphs and scale drawing
parallel lines; right angle; rectangle	concept of area; perimeters; area of rectangle	area of general parallelogram; identification of solids; concept of volume; volume of rectangular prism	geometry
	reading and understanding through hundredths	addition; subtraction; multiplication; division	decimal fraction numerals
	introduction (as ratio)	complete development	per cent
s AS-5, AS-6, C-4 (limited to "how many times as many as")	types R-1, R-4, R-5 (extended to ratios); R-2, R-3, R-6 (complete); C-4, C-5, C-6 (fractions excluded)	types C-4, C-5, C-6 (extended to fractions); C-2, C-3 (complete)	problem solving (see chart on pages 358-359)
	extended to include common fraction numerals	extended to include decimal fraction numerals	meaning of the processes
grade 4	grade 5	grade 6	topic

Word list

This list contains the 722 different words that appear in *Seeing Through Arithmetic 4*. Of these 722 words, 411 were used in the preceding book, *Seeing Through Arithmetic 3*. These 411 words are in italics. Children who have completed The New Basic Reading Program of the Curriculum Foundation Series, through the new *More Streets and Roads* (3^2), will be familiar with 209 of the 311 words not used in *Seeing Through Arithmetic 3*. Words in this list that are used in The New Basic Reading Program, through the new *More Streets and Roads* (3^2), are indicated by asterisks (*). For these children, only 102 words will be new in this book. Of these 102 words, 34 are used in the new *Times and Places* (4^1) and the new *More Times and Places* (4^2). Children using The New Basic Reading Program will have to cope with only 68 additional words.

The numeral at the right of each word indicates the page of first occurrence. For a list of words introduced in each lesson in the pupil's book, see the Lesson Briefs for the lesson in this *Teaching Guide* (pages 15 to 225).

The following forms of known words are not counted as new and therefore are not listed: inflected forms made by adding or dropping *-s, -es, -d, -ed, -ing, -n, -en, er,* or *est* of comparison (including those forms made by changing *y* to *i,* changing *f* to *v,* dropping the final *e,* or doubling the final consonant in the root word); derivatives formed by adding or dropping *er* of agent or the suffixes *-en, -ly, -y, -th, -ty, -ful, -less, -ish, -ness,* and *-teen* or the prefixes *dis-, im-, un-,* or *re-*; possessives; compounds of known words; and contractions in which the apostrophe represents not more than two omitted letters; compounds of known words and parts of previously hyphenated compounds.

*a, 4
abbreviations, 109
*able, 5
*about, 3
*above, 9
acorns, 17
*add, 18
addition, 17
*after, 53
*afternoon, 97
*again, 184
*airplanes, 78
*all, 17
*also, 32
altogether, 53
*always, 82
amounts, 74
*and, 3
angles, 238
*animals, 35
*Ann, 17
*another, 7
*answer, 20
*any, 5
*apart, 238
apiece, 67
*apples, 31
April, 178
*are, 4
*around, 169
art, 139
*as, 5
aside, 143
*asked, 165
*at, 4
*ate, 130
average, 234
*away, 32
*baby, 69
*back, 135
*bag, 42
*baked, 223
*ball, 31
*balloons, 53
bananas, 6
*banks, 62
bars, 66
baseball, 43
*baskets, 42
bats, 155
*be, 4
*beach, 28
beads, 115
*bean, 44
*because, 122
*beds, 42
*been, 31
*bees, 249
*before, 32
*began, 35
*beginning, 4
*bells, 105
*belongs, 7
*below, 9
*best, 4
*better, 97
*Betty, 17
*bicycles, 175
*big, 95
*Bill, 17
*birds, 19
*birthday, 93
*black, 172
blocks, 110
*blue, 29
*boats, 67
*Bob, 35
*boils, 9
bones, 223
*books, 27
*born, 178
*both, 12
bottles, 29
*bought, 29
*box, 6
*boys, 17
*bridge, 228
*bring, 19
*broke, 69
*brother, 42
*brought, 19
*brown, 52
*buggy, 78
bulbs, 182
*bunches, 67
bundle, 24
buns, 66
*burn, 42
*bushel, 232
*but, 41
*butterflies, 17
*buttons, 142
*buy, 29
*by, 46
calendar, 178
*called, 5
*came, 44
*cameras, 63
*can, 4
*candy, 6
*cap, 95
card, 4
Carol, 17
*carried, 95
carrots, 172
*cars, 53
carton, 178
*castle, 95
*catch, 137
*cats, 42
*caught, 137
cents, 29
*chairs, 68
chalk, 139
*changed, 8
check, 11
*chicken, 108
*child, 52
*children, 17
china, 90
*chocolate, 43
*circle, 215
*cities, 179
class, 23
clerk, 55
*clocks, 226
*clown, 157
club, 199
*coal, 229
coins, 78
*cold, 8
collar, 101
*collected, 17
collection, 28
*colored, 44
combs, 84
*coming, 17
compares, 208
compute, 86
conductor, 242
cones, 27
*cookies, 43
*cooking, 9
*corners, 238
correct, 4

cost, 66
**could*, 4
**counted*, 19
**cows*, 206
crayons, 29
*cross, 80
*cupboard, 36
**cupcakes*, 42
**cut*, 52
date, 178
*David, 104
**day*, 9
*deep, 174
degrees, 8
**Dick*, 23
**did*, 18
**different*, 67
**dime*, 67
*dishes, 81
*distance, 168
divide, 55
division, 55
divisor, 129
**do*, 4
**does*, 4
**dogs*, 90
**dollar*, 70
**dollhouse*, 89
**dolls*, 68
**Don*, 5
**down*, 8
**dozen*, 108
*drank, 29
**drawing*, 35
**dresses*, 69
*drew, 35
*drink, 178
*dry, 232
**duck*, 95
dues, 157
*dug, 136
*during, 94
**each*, 12
**earned*, 80
*easier, 5
**eats*, 101
**eighteen*, 11
**either*, 23
*elevator, 228
**eleven*, 31
**Ellen*, 19
**empty*, 32
*end, 4
*engine, 78
**enough*, 10
equal, 25
equation, 129
erasers, 38
*even, 98
*every, 150
*exactly, 68
example, 192
fair, 97
*family, 89
*far, 5
**farmer*, 9
**father*, 27
*feeding, 23
**feet*, 10
**fence*, 168
**fewer*, 79
**field*, 153
**fifteen*, 23
**figure*, 18
*fill, 165
**find*, 4
*finish, 7
**firemen*, 67
**first*, 18
*fish, 28
**five*, 11
*flagpole, 95
*flashlights, 63
**flew*, 23
**flowers*, 29
fluid, 230
folders, 133
**food*, 101
**foot*, 4
**for*, 12
forks, 224
forty, 11
**found*, 18
**four*, 11
fractions, 208
freezes, 9
*Friday, 124
**friends*, 94
**from*, 6
*frosting, 42
**fruit*, 177
*full, 184
gallon, 10
**game*, 52
**garden*, 42
**gave*, 27
**gets*, 9
**girls*, 18
**give*, 28
**go*, 5
*goldfish, 29
**gone*, 86
*good, 98
**got*, 53
graders, 29
**groceries*, 108
**ground*, 23
**groups*, 16
*grown-ups, 180
**had*, 27
**half*, 70
hamburger, 66
*happens, 129
*hard, 99
**has*, 8
**hats*, 52
**have*, 3
**he*, 27
**head*, 98
*heavier, 139
height, 97
**help*, 9
**her*, 42
**here*, 4
*herself, 132
**highest*, 9
**him*, 28
**his*, 5
*hits, 168
hobby, 142
**hold*, 101
**home*, 6
*honey, 10
**horns*, 107
**horses*, 87
*horseshoes, 174
*hot, 193
**hour*, 109
**how*, 4
**hundred*, 11
**I*, 97
*ice-cream, 124
**if*, 4
**imagine*, 86
**in*, 3
**inches*, 4
*inning, 168
*instead, 145
**is*, 4
**it*, 4
**Jack*, 53
*Jane, 78
January, 178
*jars, 10
**Jim*, 27
*John, 21
*join, 16
**juice*, 173
July, 178
June, 178
junior, 80
**just*, 45
**keep*, 35
*kept, 35
**kinds*, 158
kit, 78
*kitchen, 242
**kitten*, 101
*knew, 137
**know*, 5
*lake, 237
**lamps*, 170
**large*, 35
**last*, 19
*later, 180
**learn*, 3
**leaves*, 23
**left*, 20
lemonade, 165
length, 4
less, 10
**lesson*, 3
*let's, 98
*letters, 225
library, 41
*lights, 58
**like*, 46
**line*, 80
liquid, 8
**little*, 7
*lives, 226
lollipops, 86
**long*, 4
**look*, 4
Los Angeles, 179
*lost, 42
*lot, 194
*lowest, 9
**lunch*, 83
**made*, 6
magazines, 123
magnet, 68
**make*, 7
**man*, 101
**many*, 4
map, 238
**marbles*, 42
**March*, 178
marks, 3
marshmallows, 193
**Mary*, 10
**match*, 86
**May*, 94
*meal, 101
**means*, 46
measurement, 109
measuring, 3
*meets, 157
**mice*, 44
*might, 5
*mile, 226
**milk*, 10
millions, 126
minnows, 134
minus, 98
**minute*, 109
**missed*, 236
*model, 87
**Monday*, 29
**money*, 68
month, 109
**more*, 3
**morning*, 97
**mother*, 10
moths, 45
*moved, 6
movie, 122
*Mr., 170
*Mrs., 52
**much*, 6
multiplication, 46
multiplied, 46
**must*, 18
**my*, 98
*name, 79
**Nancy*, 43
napkins, 165
*nearly, 97
**need*, 39
neighborhood, 199
**new*, 20
**next*, 8
**nickel*, 70
**nine*, 15
*no, 12
**not*, 6
notebooks, 84
*nothing, 6
*notice, 129
**now*, 5
**numbers*, 11
numerals, 3
**of*, 4
*off, 97
*often, 109
*old, 90
**on*, 3
*once, 79
**one*, 4
*only, 79
**open*, 36
or, 4
**oranges*, 108
*orders, 150
**other*, 5
ounces, 10
*our, 100
**out*, 41
**over*, 20
*own, 161

*package, 6
*pages, 6
*paid, 29
*pail, 95
*painted, 29
*pans, 182
*paper, 29
parallel, 238
*parts, 208
*party, 43
*pay, 78
peaches, 108
*peanuts, 50
peck, 232
Peggy, 23
pencils, 24
pennants, 168
*pennies, 66
*people, 139
per, 234
persons, 123
*pet, 101
*picked, 42
*picnic, 31
*picture, 4
*pieces, 29
*pigs, 170
*pile, 149
pine, 27
*pins, 60
pints, 10
*place, 12
*plain, 42
*plants, 9
*plate, 42
*playing, 31
plus, 30
*point, 4
*pond, 90
*ponies, 175
*pool, 96
*popcorn, 46
populations, 179
postcards, 29
*potatoes, 233
pounds, 6
*poured, 194
*present, 90
*prizes, 113
problem, 78
*promised, 142
puppet, 147
*put, 4
*puzzles, 55
quart, 10
quarter, 70
*question, 12
*race, 52
radio, 94
rails, 238
*raked, 42
*read, 8
*ready, 54
records, 68
rectangle, 239
*red, 29
remainder, 118
*remember, 18
rented, 174
*rest, 35
*ribbon, 10
*ride, 53
*right, 98
*ring, 174
*road, 237
*roast, 193
*rocking, 68
*rode, 96
*rolling, 60
Roman, 225
*room, 27
*roundhouse, 78
*rows, 47
*rubber, 95
rulers, 3
*run, 166
*said, 43
sale, 67
*same, 5
*sandwiches, 31
*Saturday, 124
*saved, 68
*saw, 35
*say, 97
scale, 5
*school, 19
science, 35
*scrapbook, 124
screens, 42
*seats, 169
*second, 43
*see, 16
*seeds, 44
*seems, 100
*sell, 66
*sent, 94
separate, 16
September, 178
*sets, 68
seventy, 11
*shape, 222
shared, 95
*sharp, 100
*she, 10
*sheep, 206
sheets, 35
shelf, 24
*shells, 20
*shorter, 10
*should, 5
*show, 4
*side, 223
*signals, 57
*signs, 58
*single, 34
*sister, 69
*sitting, 169
*six, 15
*size, 179
*skating, 174
*small, 35
snails, 43
*so, 52
soap, 84
*sold, 43
*something, 6
*sometimes, 9
soup, 176
spelling, 236
*spend, 66
*spent, 66
spools, 123
*spoons, 47
square, 215
*stamps, 87
*start, 94
*step, 226
*stick, 4
*still, 39
*stones, 21
*store, 6
*strawberries, 172
*string, 10
subtract, 32
subtraction, 31
*such, 54
Sue, 52
*sugar, 158
sum, 18
*summer, 94
*suppose, 234
*sure, 6
*surprise, 55
*swimming, 174
syrup, 91
*table, 44
tablets, 84
tadpoles, 171
*take, 32
*tall, 97
tanks, 28
*teach, 118
*teams, 52
*tell, 79
temperature, 8
*ten, 11
test, 17
*than, 30
*that, 4
*the, 4
*their, 36
*them, 3
*then, 17
*there, 7
thermometer, 8
*these, 5
*they, 6
*think, 10
*thirty, 15
*this, 3
*those, 153
*thousand, 11
*three, 7
*throw, 137
*tickets, 66
*to, 4
*together, 21
*told, 137
*Tom, 6
tomato, 164
ton, 228
*Tony, 108
*too, 101
*took, 35
*toothbrushes, 84
toothpaste, 84
*tops, 64
total, 136
*town, 241
*toy, 55
*train, 227
*trees, 29
triangle, 239
*trip, 223
troop, 157
*trucks, 68
*try, 19
*Tuesday, 29
*turn, 21
*turtles, 44
*twelve, 23
*twenty, 75
*two, 6
*understanding, 11
*until, 113
*up, 8
*us, 182
*used, 4
vanilla, 165
vase, 43
wading, 96
*walked, 96
*walls, 53
*want, 5
*warm, 8
*was, 29
*washing, 81
*water, 9
*way, 4
*we, 8
*weekend, 28
weighed, 6
weight, 6
*went, 66
*were, 4
*what, 4
*when, 5
*where, 7
*whether, 87
*which, 4
*whistles, 64
*white, 44
*who, 174
*whole, 208
*why, 3
*wide, 206
*will, 3
*window, 44
*with, 4
*wonder, 93
*woods, 19
*words, 109
*work, 17
*worms, 136
*worry, 9
*worth, 66
*would, 4
*wrapped, 133
*write, 8
*wrong, 5
wrote, 178
*yard, 10
*year, 55
*yellow, 29
*you, 3
*younger, 173
*your, 5

Mathematical content

Numerals and the number system
- Reading and writing numerals through millions
- Place value through millions
- Regrouping as required in carrying and borrowing
- Roman numerals to XXXIX
- Numerals as labels
- Rounding off numbers
- Numerals for fractions

Addition of whole numbers (reteaching)
- Addition of three or more one-figure numbers
- Addition of two-figure numbers
- Addition of three-figure numbers
- Addition involving the dollar sign and point
- Checking addition

Subtraction of whole numbers (reteaching)
- Subtraction of two-figure numbers
- Subtraction of three-figure numbers
- Subtraction involving the dollar sign and point
- Checking subtraction

Multiplication of whole numbers
- Basic facts through products of 36 (reteaching)
- Basic facts, products 40 to 81
- Effect of changing order of factors
- *Zero* and *one* in multiplication
- Multiplication by numbers ending in one or more zeros
- Multiplication of two-figure and three-figure numbers by one-figure multiplier
- Multiplication of two-figure and three-figure numbers by two-figure multiplier
- Multiplication involving the dollar sign and point
- Checking multiplication

Division of whole numbers
- Basic facts through dividends of 36 (reteaching)
- Basic facts, dividends 40 to 81
- *Zero* and *one* in division
- Division by one-figure divisor, quotients of two figures
- Division by two-figure divisor, quotients of two figures (optional work)
- Division involving numbers representing money
- Remainders in division, meaning of
- Checking division

Measurement
- Concept of standard unit and scale
- Recognition of right and wrong procedures
- Measures of temperature (Fahrenheit)
- Measures of liquid capacity—fluid ounce, tablespoon, cup, pint, quart, gallon
- Measures of dry capacity—pint, quart, peck, bushel
- Measures of weight—ounce, pound, ton
- Measures of length—inch, foot, yard, mile
- Measures of time—second, minute, hour, day, week, month, year
- Abbreviations for all measurement units taught
- Reduction of measurement units

Money
- Recognition of coins and paper money (reteaching)
- Value relations among the coins (reteaching)
- Counting money (reteaching)
- Making change (reteaching)
- Reading and writing numerals that represent money
- Addition, subtraction, multiplication, and division involving the dollar sign and point

Fractions
- Concept of fractions (reteaching)
- Unit and non-unit fractions (denominators to 16)
- Improper fractions and mixed numbers
- Equivalent fractions for denominators taught
- Fractions applied to the inch
- Comparing fractional parts

Geometry
- Parallel lines and right angles
- Recognition of rectangle, square, and triangle
- Linear scale to measure distances on a map

Problem solving
- Finding the new total group when the sizes of the smaller groups are known
- Finding the remaining group when the size of the removed group is known
- Finding the new total group when the size and number of the equal smaller groups are known
- Finding the number of equal groups when the size of the equal groups is known (quotition)
- Finding the size of the equal groups when the number of equal groups is known (partition)
- Finding how many were added or how many more are needed when the number to begin with and the resulting total number are known
- Finding how many there were to begin with when the number added and the resulting total are known
- Comparing two groups by finding how many more or how many fewer one group is than the other
- Finding how many are gone when the number to begin with and the number left are known
- Finding how many there were to begin with when the number gone and the number left are known
- Finding how many times as large one quantity is as another quantity (comparison by division)

Index

The purpose of this index is to help you locate material in this *Teaching Guide* that pertains to the *teaching* of various arithmetical concepts. For location of subject matter in the pupil's text, see the index to the text.

Abbreviations (measurement terms), 108-109
Able pupils, providing for. (Each block of Expanded Notes, pages 227 to 328, contains suggestions for special work for able pupils.)
Achievement, measurement of, 244-245
Action principle, 9-11, 27, 243, 249-250, 254-255, 260-261, 264, 273, 300
Activities, 329-352 (*See also* Able pupils and Slow learners), addition of one-, two-, and three-figure numbers, 331, 334, 335, 336-337, 338-339
  basic facts, 332-333, 339, 345, 349-350
  division, with remainders, 349-350
  fractions, 351-352
  measurement, 330
  money, 346, 348-349
  multiplication of two- and three-figure numbers, 339, 351
  number system, 331, 336
  problem solving, 337-338, 350
  subtraction of two-, three-, and four-figure numbers, 336, 338, 339
Addends, order of, 29
Addition
  additive situations defined, 9, 10, 27, 36, 51, 243, 249-251, 327
  carrying in, 8, 31-33, 34-36, 244, 247-249
  checking in, 181-182
  column addition, 29-30, 246
  computational form, 243-244, 246
  diagnosis of weaknesses in, 39, 245
  differentiated from multiplication, 27, 256
  imagined action in, 28, 37, 128, 130, 245, 250, 296, 297
  in problem solving, 36-38, 128, 130, 249-251, 296, 297, 327
  mental computation, 29, 100-101, 246-247, 282-283
  of money, 82, 270-271
  preparation for carrying in, 23-25, 239, 241, 248
  process of, 29-35, 243, 245-249
  relation to subtraction, 181
  review of basic facts, 28, 245
  three-figure numbers, 34-36, 248-249
  two-figure numbers, 31-33, 247-248
  zero in, 31, 33, 35, 249
Additive-addition, 9, 36, 51, 243, 249-251, 327
Additive-subtraction, 10, 90, 94, 276, 279-280
Answer key, equation in, 37
Approximating, *see* Rounding off numbers
Average, finding, 209-211, 326-328
Basic fact, *see* Addition, Division, Multiplication, and Subtraction
Bibliography, 355-357
Borrowing, *see* Subtraction
Calendar, 165, 309
Carrying, *see* Addition and Multiplication
"Chain" problems, 145
Change making, *see* Money
Charting the course, 228-229, 238-239, 243-244, 251-252, 256-257, 260-261, 265, 273-274, 283-284, 290, 292, 295, 298-299, 306, 309-310, 319-320, 326-327
Checking, in the four processes, 181-182
"Checking up," purpose and administration of, 28, 120, 167, 223, 244-245
Clock, 18, 230-231
Commutative law, 284, 299
Comparison
  by division, 158-160, 306-307
  by subtraction, 88-89, 273-275,
Computational form, 243-244, 285, 304
"Crutches," use of, 42, 248, 253
Diagnostic tests, 244
Division
  arrangement of work, reasons 169-170, 310
  basic facts, 62-68, 70-71, 105-112-114, 260-264, 283-284, 286, 288
  checking in, 181-182
  comparison of groups by, 158-306-307
  computational form in, 261, 310
  distinguished from subtraction, 62
  division tables, 261, 263
  finding the number of equal gr 69-70, 264-265, 308, 315-31
  finding size of equal groups, 119, 290-291, 308, 315-317,
  in finding averages, 209-211,
  of money, 179-181, 315-318
  one-figure divisor, two-figure tient, 169-175, 311
  one (1) in, 124-125
  partial quotients in, 170, 176, 313, 314
  partitive, 117-119, 261, 290-308, 315-317, 327
  process of, 169-175, 261, 262, 313
  quotitive, 69-70, 261-263, 285-288, 289, 308, 315-316, 318
  remainders in, 115-116, 163-289, 311, 313
  two-figure divisor, 183-187, 318-319
  zero in, 124-125, 292, 310

visive situations, 27, 261, 264-265, 278, 279, 290-291, 306-307, 308-309, 315-318, 327
y measure, *see* Measurement
ual groups
finding number of, 69-70, 285-286, 315-316, 318-319
finding size of, 117-119, 290-291, 315-317, 327
uation form, use of in practice exercises, 243-244
uations
nd imagined action, 36-38, 250, 254-255, 274-275, 327
mportance of, 71-72
n problem solving, 11, 36-38, 48-50, 58-59, 69, 71, 88-92, 94-96, 117-119, 125-131, 158-160, 209-211, 245, 249-250, 254-256, 260, 264-265, 273-277, 279-280, 290-291, 295-298, 306-309, 315-317, 327-328
nvolving money, 94
s. computational form, 11, 243
ivalents, *see* Fractions, Measurement, and Money
aluation procedures, 245
panded notes, 227-328
lescription of content, 5
ctors, order of, 54-55, 56-58, 133-135, 284
ur-step teaching method, 12, 29, 245-246
ctions
nd geometric figures, 199
qual and unequal parts, 199
quivalent, 192-194, 322
mproper, 195-197, 323-324
n measurement, 197-198, 325-326
neaning of, 190, 319-320
nixed numbers, 195-197, 323-324
preparation for reduction of, 192-194, 195-197, 323-324
nit and non-unit, 190-192
ometric figures, 213-215
stalt approach, 8-9, 244, 252
ade placement chart, 360-361
puping, *see also* Number system
y tens, 28, 54-58, 103-107, 110-111, 238, 257, 258, 259, 283, 285, 287, 288
Groups
in division, 69, 261, 264, 285-286, 288, 290-291, 315, 327
in measures, 92-93, 278
in multiplication, 54-58, 256, 283-284, 287
Individual differences, providing for, 229. (Each block of Expanded Notes, pages 229 to 328, contains detailed suggestions for handling individual differences, labeled "Providing for the able pupil" and "Helping the slow learner.")
Insight and arithmetic, 6-9, 290
Introduction, 4-14
Linear measures, *see* Measurement
Liquid measures, *see* Measurement
Long division, 169-170, 183-187, 309-313, 318-319. *See also* Division
Map, meaning of scale on, 215-217
Measurement
abbreviations, 108-109
dry measures, 208-209
equivalents, 22-23, 109, 230, 233, 278-279
fractions in, 197-199, 325-326
linear, 16-19, 202-204, 228-230
liquid measures, 206-207
reduction of, 92-93, 278-279
thermometer, reading of Fahrenheit, 18, 21-22, 229, 231, 236-238
weight, 18, 19-20, 204-205, 230, 231, 233-236
Measurement division, *see* Quotitive division
Mental computation, 29, 100-102, 246-247, 274, 282-283
Mixed numbers, 195-197, 323-324
Money
addition of, 82-83, 270-271
as application of number system, 73, 265
counting, 73-76, 265, 266-267, 268
diagnostic test for, 86
division of, 179-181, 315-318
equivalents, 74, 266, 267
making change reviewed, 78-80, 265, 269-270
multiplication of, 143-145, 162-163, 302-303
subtraction of, 83-84, 272-273
writing reviewed, 76-78, 267-268
Multiplication
and number system, 8, 131-132, 147-149, 283, 299
and problem solving, 58-59, 152, 155, 260
basic facts, 9, 54-58, 60, 103-105, 109-111, 114-115, 256-260, 283-285, 287
by two-figure numbers ending in zero and by three-figure numbers ending in two zeros, 147-149
carrying in, 8, 135, 139, 299, 300-301, 304, 305
checking in, 181-182
distinguished from addition, 27, 54, 256
imagined action in, 257, 258
meaning of, 27, 54, 256, 283, 300
multiplication tables, 256, 258
of money, 143-145, 162-163, 302-303
of numbers ending in one or more zeros, 133-134, 298-300
one (1) in, 124-125
process of, 147-149, 298-299
three-figure multiplicand, 139-142, 301-302
two-figure multiplicand, 135-138, 300-301
two-figure multiplier, 149-152, 303-305
zero in, 124-125, 292, 299
Multiplicative situations, 27, 54, 256, 260, 278
Numbers, *see* Number system
Number system
and money, 73, 265
and multiplication, 18, 131-132, 147-152
extension to improper fractions and mixed numbers, 320
grouping and regrouping in, 12, 23-26, 122-124, 238-239, 241-242
millions' place, 122-124, 292, 293, 294
place value in, 23-26, 122-124, 238-239, 241, 242, 292-295
review of tens', hundreds', and thousands' places, 23-26, 240-241, 242, 293
use in addition, 31, 34, 247, 248
zero in, 24, 240

Numerals as labels, 212-213
One (1) in division and multiplication, 124-125
Organization of content, simplified, 7-9
Parallel lines, 213-215
Partial quotients, 170-175, 176, 310, 313, 314
Partitive division, *see* Division
Place value, *see* Number system
Play money, making, 73, 266
Practice, purpose of, 14
Problem chart, 358-359
Problems, *see also* Problem solving
  "chain," 145
  chart of types, 358-359
  procedures for administering sets of problems, 96, 102, 177, 250-251
  two-step, introduction to, 209, 327
Problem solving
  addition in, 36-38, 249-251
  analysis of problem situation, 9-11
  choosing the correct process in, 11, 71-73
  comparison of groups by division, 158-160, 306-307
  division in, 69-70, 163-165, 264-265, 290-291, 306, 308-309, 315-318, 327
  finding how many are gone when number to begin with and number left are known, 125-128, 295-297
  finding how many more or fewer, 88-89, 273
  finding how many there were to begin with when number added and total are known, 94-96, 274, 279-280
  finding how many were added or how many more are needed, 90-92, 274, 276-277
  finding number to begin with when number gone and number left are known, 128-131, 296, 297-298
  finding size of equal groups, 117-119, 290-291
  finding the average, 209-211, 327-328
  imagined action in, 36-38, 48-49, 62, 88-89, 91, 95, 128, 130, 250, 254-255, 273-274, 276, 280, 296, 297, 327
  multiplication in, 58-59, 152, 155, 260
  subtraction in, 48-50, 254-256
Processes, relations among, 181-182, 261
Quotitive division, *see* Division
Rectangle, 213-215
Relationships
  addition and subtraction, 181
  multiplication and division, 181, 261, 263, 288
  division and subtraction, 170, 310, 311
Remainders in division, 115-116, 163-165, 289, 310, 313
Remedial procedures, 28, 39, 41, 51, 60, 70-71, 114-115, 120-121, 157, 189, 223-224, 245
Reteaching chart, 120, 167, 219, 223-224, 245
Review, provisions for, 243
Right angles, 213-215
Roman numerals, 201-202
Rounding off numbers, 98-99, 165-166, 274, 280-281
Scale
  on map, meaning of, 215-217
  ruler, 16-19, 229, 231, 233
  thermometer, 21-22, 229, 236-237
  weight, 18, 19-20, 229, 234, 235
Screen, use of in equations, 37, 245
Slow learners, providing for. (Each block of Expanded Notes, pages 227 to 328, contains suggestions for slow learners.)
Square, 213-215
Subtraction
  basic facts, 41, 251
  borrowing in, 8, 42-44, 45-48, 53, 61, 252-253, 253-254
  checking in, 181-182
  comparison by, 88-89, 273-275
  distinguished from division, 27
  imagined action in, 41, 48-49, 254-255, 273-274, 280, 296
  in problem solving, 48-50, 254-256, 274-276, 279-280, 295-297
  mental computation, 100-102, 282-283
  of money, 83-84, 272-273
  preparation for borrowing, 23-24, 26, 239, 241, 252, 253
  process of, 42-44, 45-48, 252-253-254
  short-cut method for use with in nal zeros, 61
  three-figure numbers, 45-48, 2 254
  two-figure numbers, 42-44, 2 253
  zero in, 253
Subtractive-addition, 10, 128-131, 2 298
Subtractive situations, 22, 48, 1 254-255, 295-297
Symbols, meaning of, 10-11
Teaching devices
  colored type, 29
  dimming off, 29, 41, 245, 247, 3 301, 304
  dotted background, 130, 299, 3 304
  four-step teaching method, 12- 29-30, 245-246
  ring, 257, 261
  screen, 37, 245, 307
  wavy line, 52, 307
Tests
  achievement, 120-121, 167-169, 2 225, 245
  administration of, 29, 43, 70, 1 120, 167, 223, 244-245
  end-of-block, 39, 50-51, 60, 70- 114-115, 120-121, 157, 189
  inventory, 28, 41, 244-245, 261,
  problem-solving, 120-121, 200-2 224-225
Thermometer, *see* Measurement
Time schedule, 229, 359
Triangle, 213-215
Visual aids, 13
Vocabulary, 13, 16, 229, 257
Wavy line, use of, 52, 307
Wholes, learning by, 8-9, 244, 252
"Word clues," 11, 37
Word list, 362-364
Zero
  and place value, 24, 240
  in addition, 31, 33, 35, 249
  in multiplication and division, 1 125
  in subtraction, 253
  multiplication by numbers end in, 133-135, 147-149

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 65 64 63 62 61 60
(2057)

QA 135 H332 1964 RK-4 TCH-GD-
SEEING THROUGH ARITHMETIC

40030981 CURR HIST

000031416068

Date Due

OCT 15 RETURN